AUTOMOTIVE and Aviation INDUSTRIES

NOVEMBER 1, 1944

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Because nothing rolls like a ball . . .

The Steel Ball, precision-ground and lapped to within *five one-hundred thousandths* of an inch in diameter or even closer, is the heart of the New Departure Ball Bearing. Sphericity is within *10 millionths of an inch!*

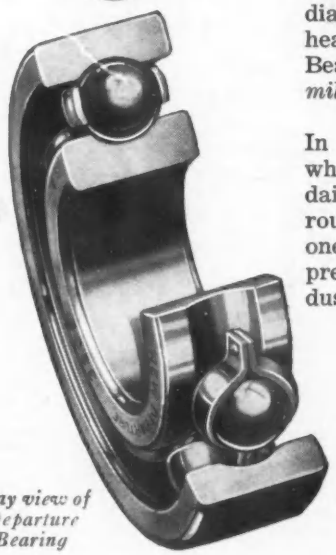
In the New Departure plants, where millions of balls are made daily, precision limits are a routine matter. In fact, this is one of the finest examples of precision manufacture in all industry.

It can well be said that our way of life depends on the ball bearing—for most every mechanical device known to man, somewhere, somehow, has ball bearings in its family tree.

New Departure's experience, resources for research, imagination and advanced techniques have produced a truly fine ball bearing.

So . . . when next you buy or build some mechanical device, ask: "Has it New Departure Ball Bearings?"

3325



Cut-away view of New Departure Ball Bearing

nothing rolls like a ball

NEW DEPARTURE

BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS CORPORATION • BRISTOL, CONNECTICUT

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NOV 14 1944

Cutting oil *News* letter

Practical suggestions from the field on how cutting oils and coolants are being used by midwest machine operators to lick tough wartime jobs.

NOVEMBER, 1944

Operators vote for Stanicut 107 BC

At the start of a bomb fuse contract, an Illinois plant used a paraffin oil and base oil mix on the automatic machines making the fuses. Other oils were tested from time to time. The last one was Stanicut 107 BC—it's the one now used. First, because operators found the work was cooler—and easier to handle—and the oil was light in color. Secondly, management found it gave better finish and tool life and eliminated a mixing job—another four-way improvement from one Standard Cutting Oil Man's suggestion.

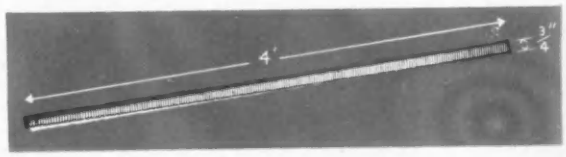
Cures "liver" trouble on forging operation

The lubricant used on forging dies in an Indiana plant was apparently satisfactory except for a "liver-like" sludge which formed when the lubricant separated. In an attempt to cure this trouble, Stanolind Forge Die Lubricant was tried. Much to the surprise of the plant men they found that not only the sludge trouble was ended but the new lubricant clung to the die better, and lubricant consumption was *cut in half*. Mention any problem, large or small, involving cutting oil or stamping compounds to a Standard Cutting Oil Specialist. You may turn his suggestions into a real saving.

Gasoline Powers the Attack . . . Don't Waste a Drop!

HD Soluble Oils—Stanicool—stops tool burning

An Illinois plant wanted to use soluble oils in a turret lathe operation on 4150 stock with high speed tools. But even with a heavy mix of 3 to 1 with conventional soluble oils, tools overheated and rejects were frequent because of poor finish and incorrect size. With no change in speed or feeds, Stanicool HD—a heavy-duty soluble oil—was tried. Even with a 5 to 1 mix, tools ran cool and rejects were almost unknown. Incidentally, soluble oil consumption was cut 50%.



Long threading job speeded up with Stanicut 309 BCS

The job of threading four feet of ¾ inch round, hot-rolled, 4130 bar stock was trying the patience of tool men in a Detroit plant. Chasers got hot and loaded so soon that it was almost impossible to get a satisfactory full length thread. Seven pieces for each grinding of the chaser was average production. Without any other change, Stanicut 309 BCS—a highly sulphurized, chlorinated cutting oil developed for heavy cutting jobs—was put on the operation. Overheating and loading of the chasers were completely eliminated. Production jumped to 24 pieces per grind.

See a Standard Cutting Oil Specialist. One of these Engineers can help you find the answer to your difficult metal working problems. Call the nearest Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago 80, Illinois, for his help. In Nebraska, write Standard Oil Company of Nebraska, at Omaha 2.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

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ANOTHER **COTTA** "ENGINEERED-TO-ORDER" TRANSMISSION AT WORK FOR IONA (MICHIGAN) COUNTY ROAD COMMISSION

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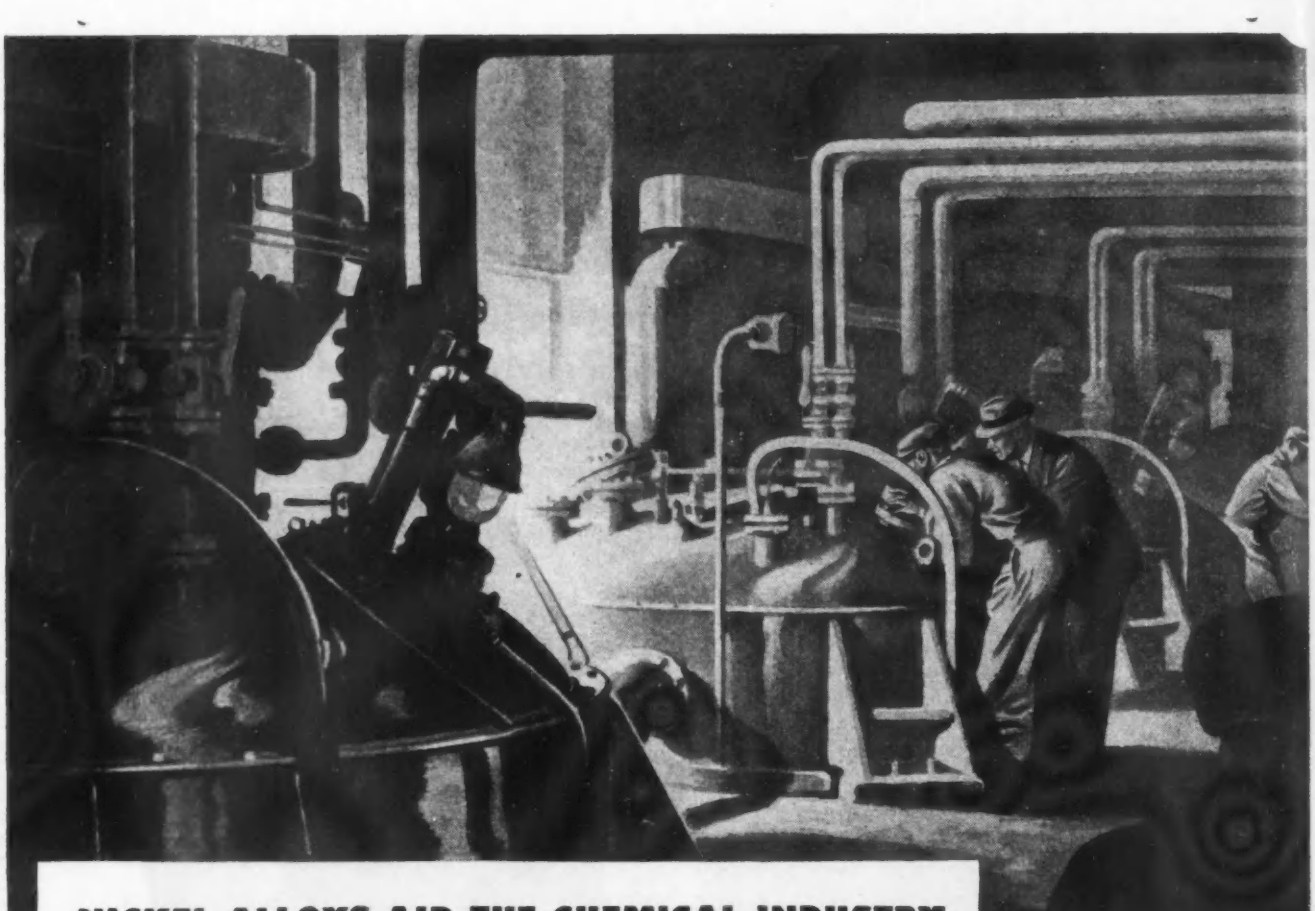

NICKEL ALLOYS AID THE CHEMICAL INDUSTRY to KEEP 'EM PRODUCING!

Stainless Steel Lined Polymerization Reactors in Synthetic Rubber Plant

Equipment of Stainless Steel, Nickel and Monel meets many specialized requirements

Chemical engineers have met America's wartime challenge.

They opened the gates to a mighty flood of products going to war... strategic raw materials, synthetic substitutes, and entirely new substances having advantages all their own.

A factor in this production success is the wide use of stainless steel, Monel, and other corrosion-resistant alloys containing Nickel.

For in the chemical industry corrosion is a large-scale menace.

To wage war on this enemy, chemical engineers enlisted the aid of Nickel, because Nickel imparts to other metals strength and resistance to corrosion and wear. In the chemical field, as in many others, a little Nickel goes a long way to keep equipment producing.

It prolongs the life of processing apparatus, and protects the purity, color, and uniformity of the product.

Hence, stainless and Nickel alloys are specified widely for acid heaters and caustic coolers, for high-pressure autoclaves and vacuum evaporators, for cracking towers and polymerization reactors, for shipping drums and tank cars, for pumps, piping and storage tanks, for agitators and settlers, for stills and digestors—for every type of equipment that converts laboratory experiments into full-scale chemical operations.

For years we have enjoyed the privilege of cooperating with technical men of the chemical industry... and of many others. Whatever your industry may be ... if you want help in the selection, fabrication, and heat treatment of alloys ... we offer you counsel and data.

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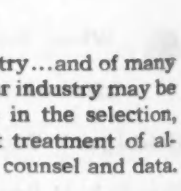

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AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Volume 91 — November 1, 1944 — Number 9

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AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

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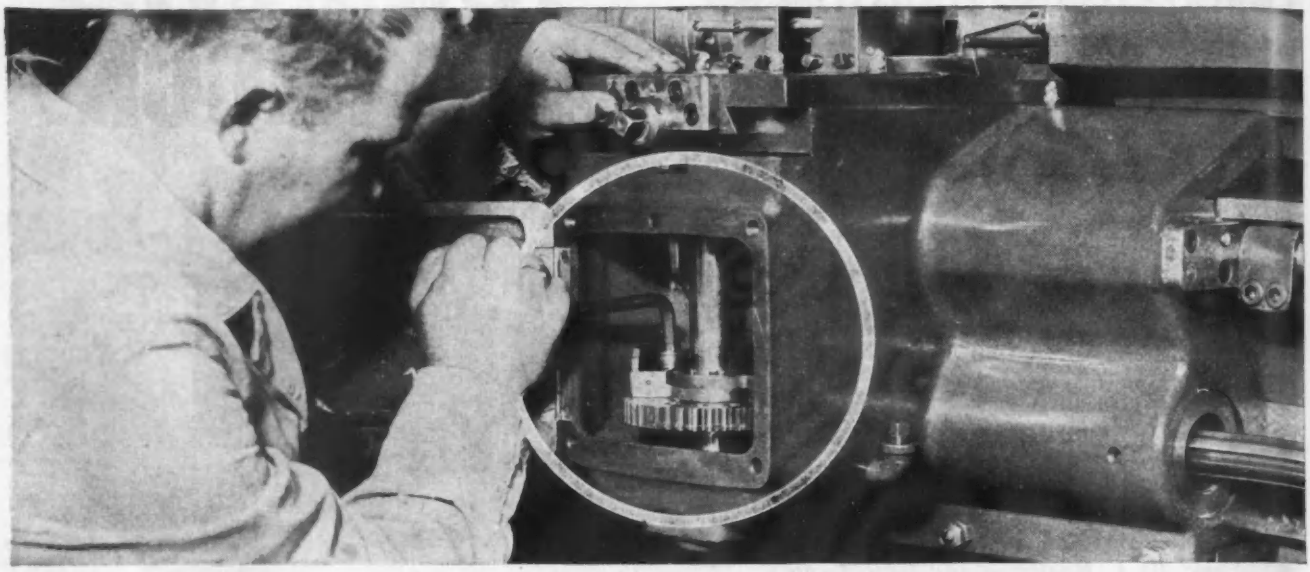
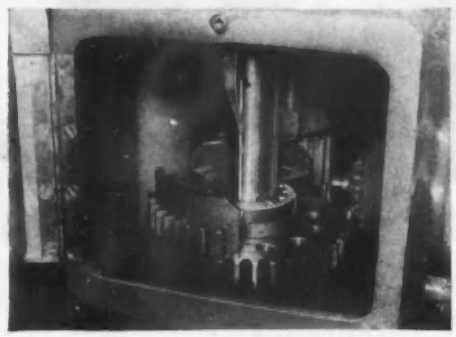
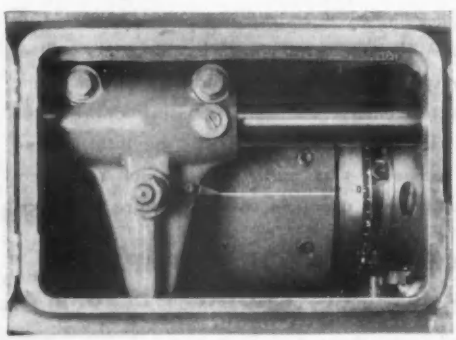


HAVE THIS *Quick Change-Over Mechanism*



Close-up view of Simplified Change-Over Mechanism.



Close-up view of drum cam showing index line and graduated adjustment ring.

● War production plants appreciate the speed and simplicity with which Lo-swing Automatic Lathes can be changed-over from job to job. Take Model LR for example: A hinged door provides easy access to the Simplified Change-Over Mechanism located on carriage front. Simply loosen two cap screws and move gear segment to graduation on scale corresponding to desired length of cut in inches. Tighten cap screws and carriage is timed for the job at hand. Cam is standard and does not have to be changed, and since the cycle is closed and locked, machine cannot get out of time.

Rapid traverse adjustment is accomplished with equal ease and speed thru the hinged door at the head end of machine. Loosen two cap screws and slide the ring which is graduated in inches around until the length of cut desired in inches is opposite the zero mark. This automatically positions the rapid traverse control cams so that the remainder of the cycle is completed in rapid traverse. A Rapid Traverse Control Handle, conveniently located just below the door opening, further facilitates this adjustment and reduces change-over time.

These and other Lo-swing features, developed in the peace-time past, are proving their value under the stress of war production.

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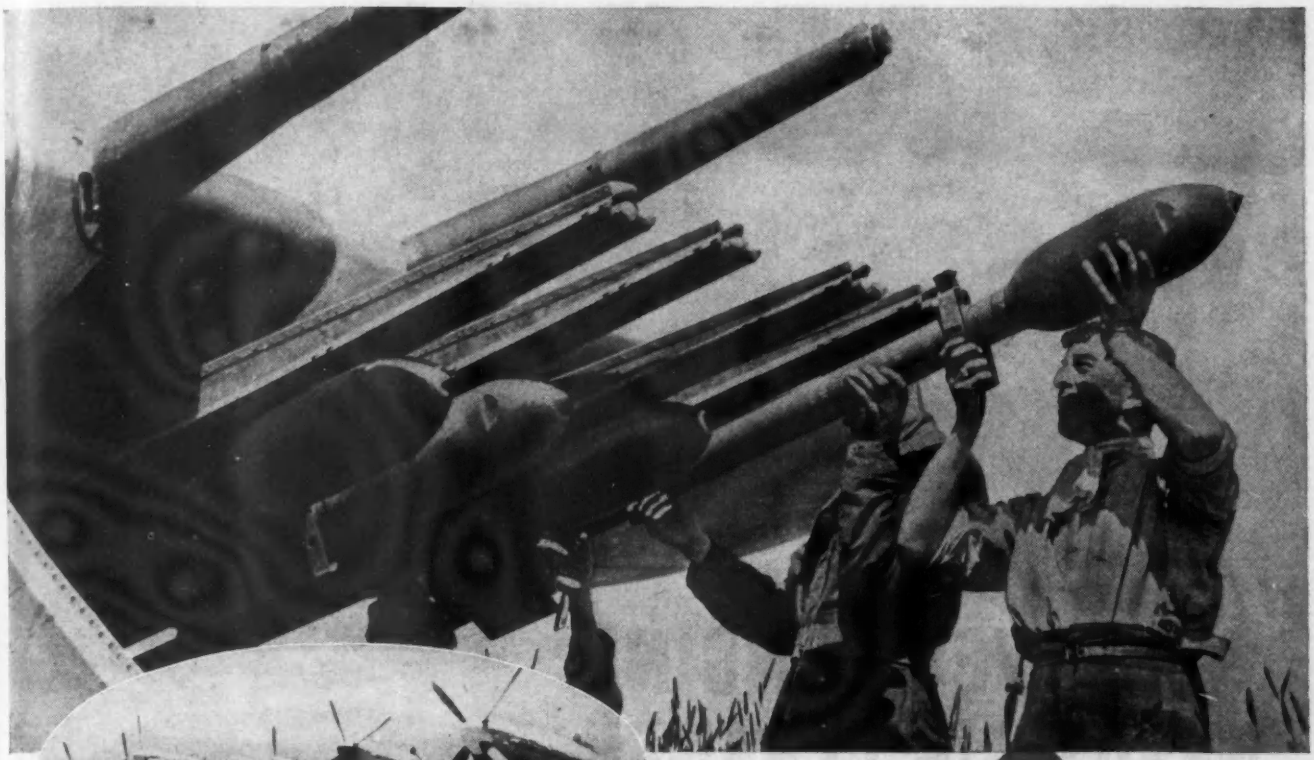
LATHE NEWS *from* SENECA FALLS



ROCKETS UNDER HER WING

DEADLY broods of rocket projectiles nestling under their wings add enormously to the destructive firepower of fighter planes in attacks on ground objectives.

Mass production of rockets and other types of munitions calls for faster machining, better finish, longer tool life ... assured by the use of Texaco Cutting and Soluble Oils.

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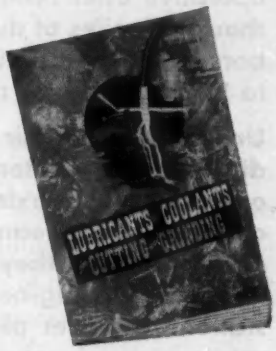

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United Oil Bath Air Cleaners remove over 99% of dirt in the air. On tens of thousands of military trucks operating under extreme conditions in every theater of war, United Cleaners are giving the same dependable protection they have been furnishing for over 19 years to engines of trucks, cars, tractors and stationary power plants.

Products born of this specialized experience will provide even higher standards of protection for the new internal combustion engines coming after the war.

United Oil Bath Air Cleaner Model T195-12100, illustrated, is used on 4-wheel drive vehicles built for our armed forces. It meets these exacting requirements of military use: (1) It has an extremely high cleaning efficiency and great dirt-trapping capacity; (2) oil reservoir is large; (3) construction is simple and solid, and (4) servicing is easy.

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The American public, the aviation industry in general and a number of aircraft manufacturers in particular would like a specific answer to this question . . . and we wish that we could give it. This much can be said, however, with but little likelihood of disagreement. At no time in the twenty-odd years since the world witnessed the first practical flight of a rotary wing ship, has professional and public interest in rotary wing flight been as active as at present, *nor has the future of the field been as promising* ★ The Autogiro Company of America has been engaged in rotary wing research and development longer than any other organization in America. Its engineering and research staff; its records of development, experimentation and thousands of hours of flight, and the right to use its numerous inventions, offer incalculable assistance to licensees. We shall be pleased to discuss details of Autogiro Company licensing arrangements with interested aircraft or other manufacturing executives ★ AUTOGIRO COMPANY OF AMERICA, Willow Grove, Pennsylvania.

Companies now producing for the war, under license from the Autogiro Company of America, include:

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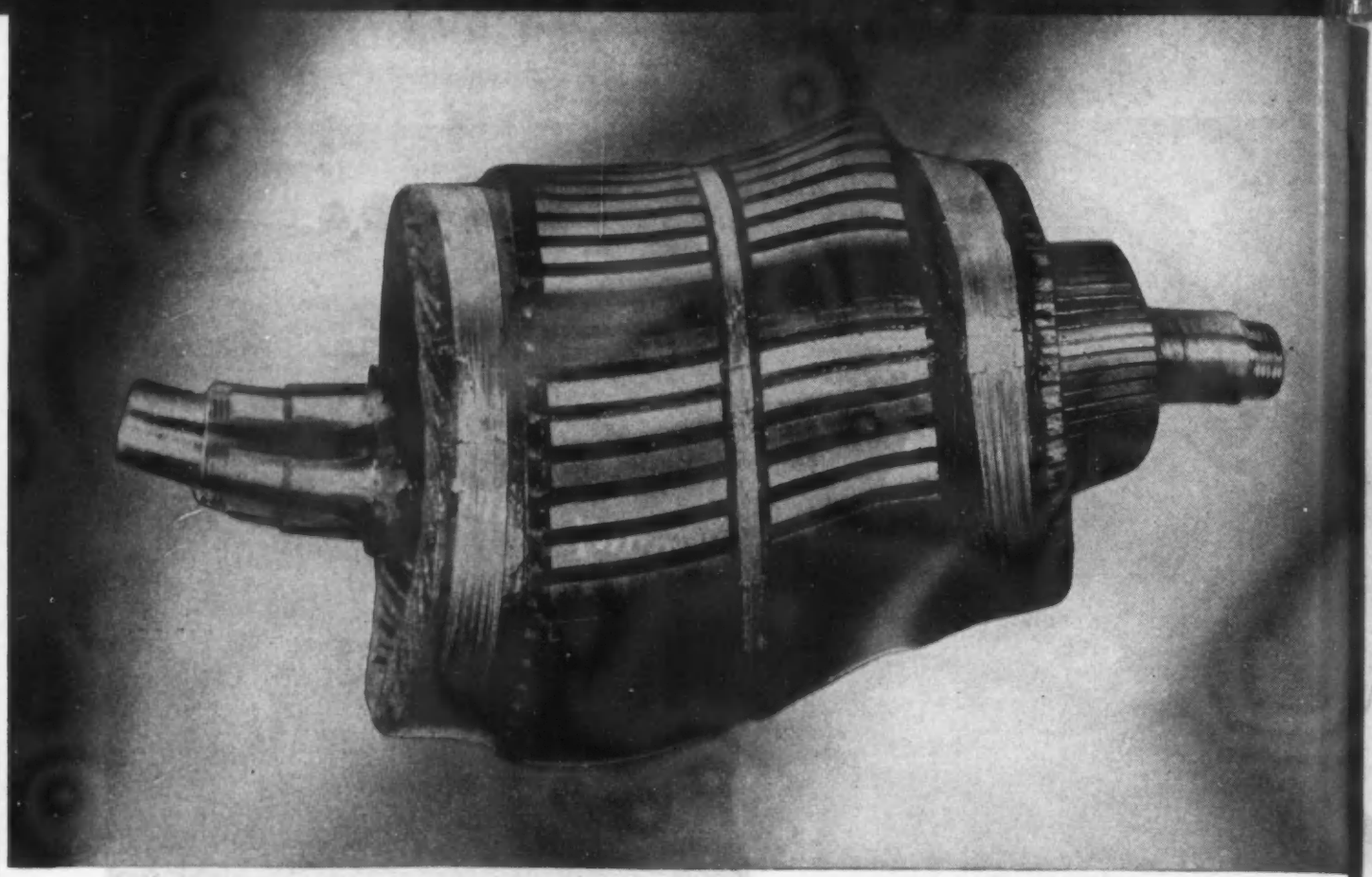
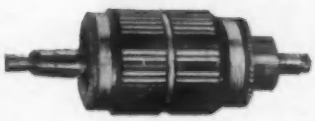


DONE WITH MIRRORS...

to make this point clear



A DISTORTION MIRROR produced this queer-looking armature. It wouldn't work—that's obvious. It wouldn't even turn in any self-respecting motor.

But the point to remember is this: any rotating part not properly balanced can be almost as unfit for service as this grotesque armature. Unbalance, perhaps just a fraction of an ounce, is enough to set up destructive vibrations once rotation starts.

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Remember, a slight unbalance may exist in the most carefully made assembly. You can't see it—but you can feel it when the piece is rotating, and it will endanger the reputation of your product. Why take chances? Investigate the Gisholt Balancing Machine today!

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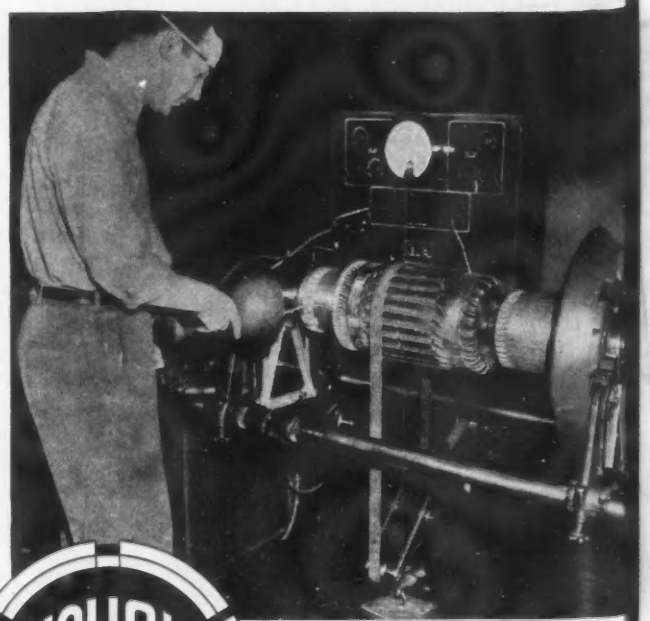

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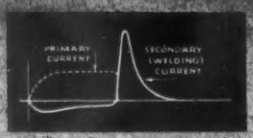

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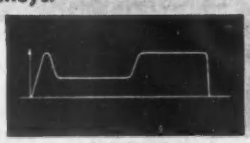

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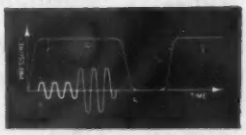

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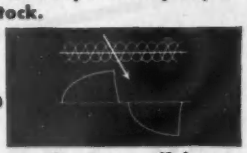

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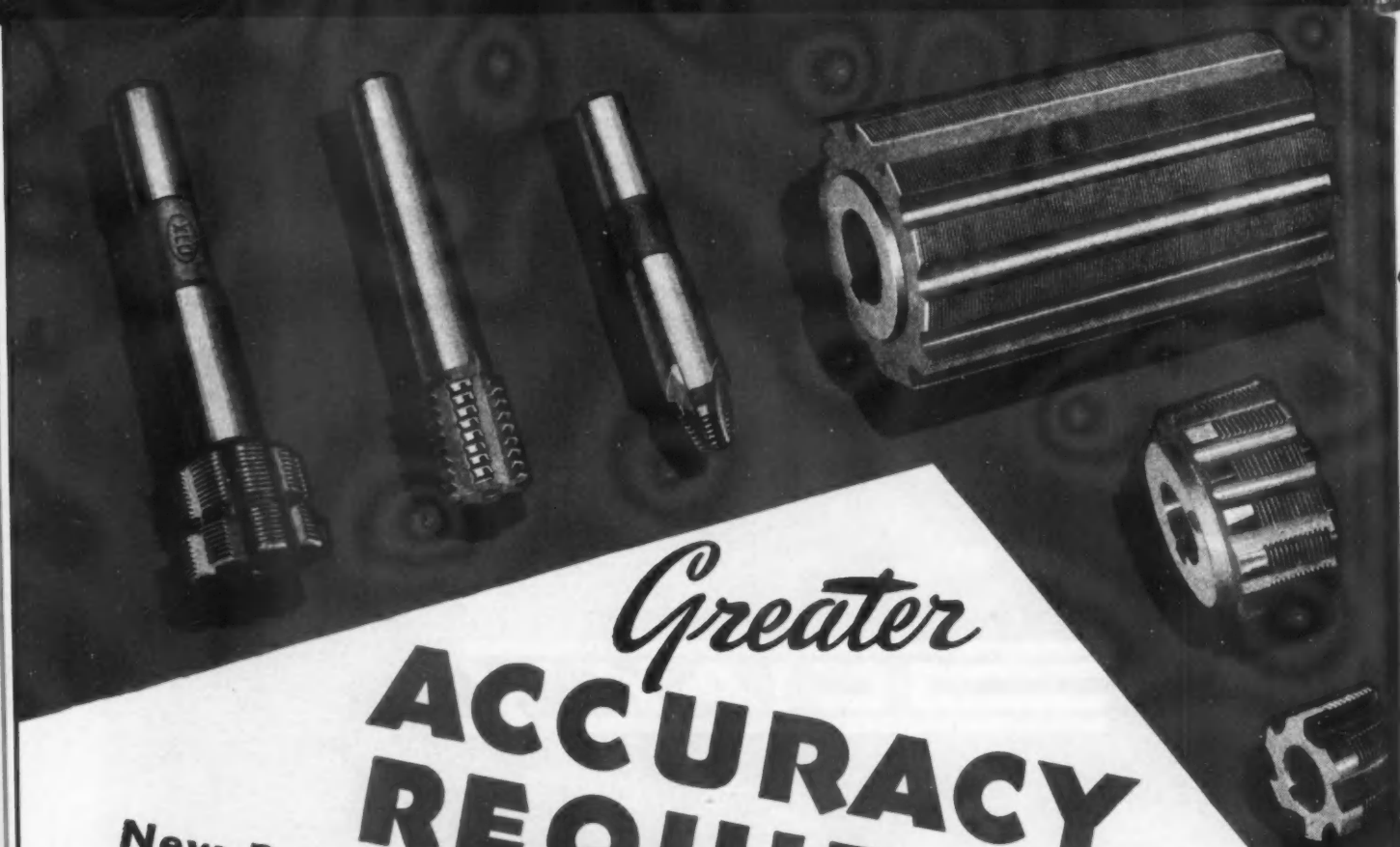

Greater ACCURACY REQUIRED

New Production Speeds and Improved Part Finish Place Emphasis on PRECISION-MADE Cutting Tools

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A new engineering production bulletin on these "aircraft quality" gears will aid your engineers in determining how they can best be applied to your product. Write for your copy today.

* * *

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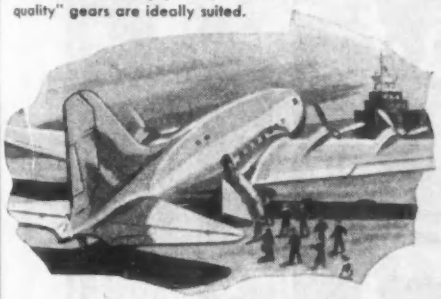
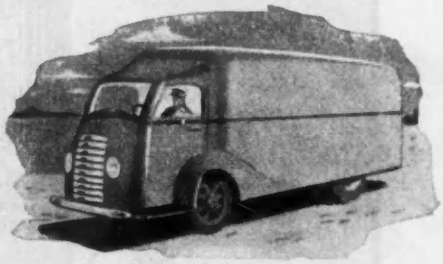
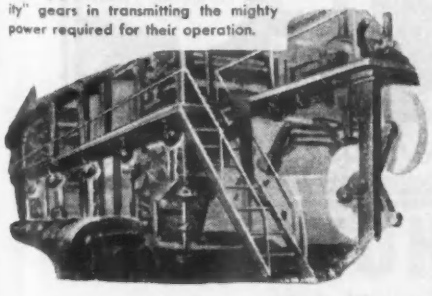


For airplane engines of every size, "aircraft quality" gears offer light weight, compact size, high speed.

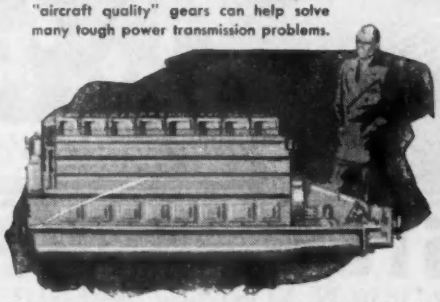
For internal combustion engines, "aircraft quality" gears transmit high speeds with a reduction of size and weight.



Printing presses can use "aircraft quality" gears in transmitting the mighty power required for their operation.

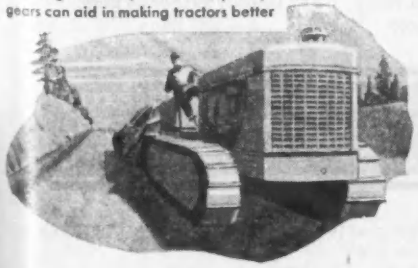


For the manufacturers of Diesel engines, "aircraft quality" gears can help solve many tough power transmission problems.

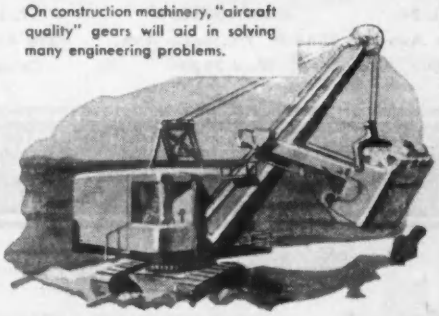


The demands of machine tool manufacturers for higher speed, lighter weight and compact design recommend "aircraft quality" gears.

Because of their ability to stand up under tough service, "aircraft quality" gears can aid in making tractors better



On construction machinery, "aircraft quality" gears will aid in solving many engineering problems.



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Please send me a copy of the Engineering Bulletin on "Aircraft Quality" Gears as soon as it is available.

Name.....

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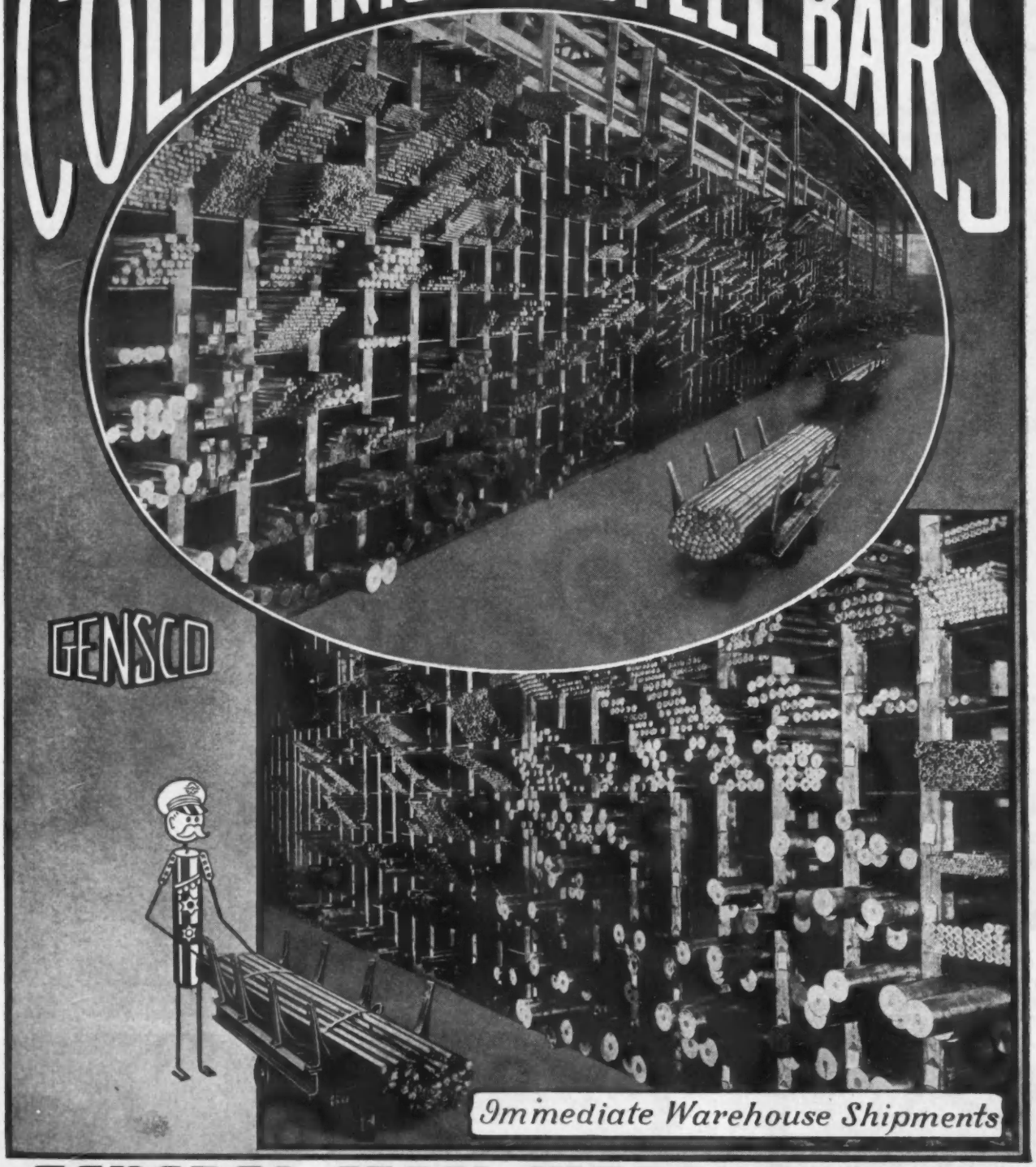
COLD FINISHED STEEL BARS



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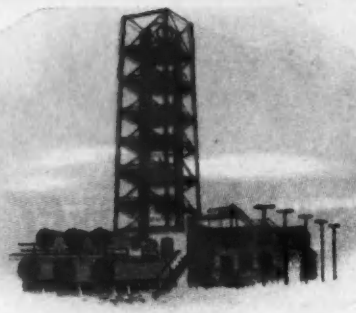

DOW ANNOUNCES

a further important

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Dow announces a further reduction in the base price of Styron to 25c per pound effective November 1, 1944.

Increased efficiency of production has made this further reduction possible. This is in keeping with the established Dow policy of manufacturing quality materials—in quantity—at low cost.

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You don't have to wait until postwar for postwar power braking! *It's here in Hydrovac*—a new kind of unit *combining both hydraulic and vacuum power* to give safer, surer toe-touch braking . . . far in advance of its field . . . the most thoroughly proved new automotive product ever offered . . . and available now to qualified users for immediate installation! If you operate, manufacture, sell, or service trucks, get the facts about this *battle-proved* power braking. See your Bendix B-K dealer or write to Brake Headquarters.

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"HYDROVAC" AND "BENDIX" ARE TRADE-MARKS OF BENDIX AVIATION CORPORATION

IN THIS ISSUE . . .

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 91 November 1, 1944 Number 9

What Happened to the French Automobile Industry 17

The author of this article is an automotive specialist who has spent the greater part of his life in France. From personal knowledge and observation he relates here what has taken place in France with respect to the automobile industry during the nine months of war and the four years of German occupation. This is a "once in a life time" offering. Read it.

Silver Bearings Precision Made 20

A job well done should be told about. Here the author tells of the outstanding accomplishments of the P. R. Mallory organization. He goes into all the details of production and the article is liberally illustrated.

Stabilizer System Adaptable to Cars 32

Many things are going to come out of this war to improve our postwar lives. Here is one that has been spotted and its application explained. It will be regular equipment some day so read about it now.

Spotwelding and Forming Aluminized Steel 33

In this article is given the result of considerable research in the use of aluminum steel to replace stainless steels. It tells just what can and cannot be accomplished. It is highly instructive and authoritative.

Fatigue Strength of Gears Increased 35

By special shaping of the gear teeth and lapping of the tooth base, was overcome a problem in gear failures. It is all explained in detail and illustrated by charts and graphs of the tests.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Our Postwar National Income

By Julian Chase

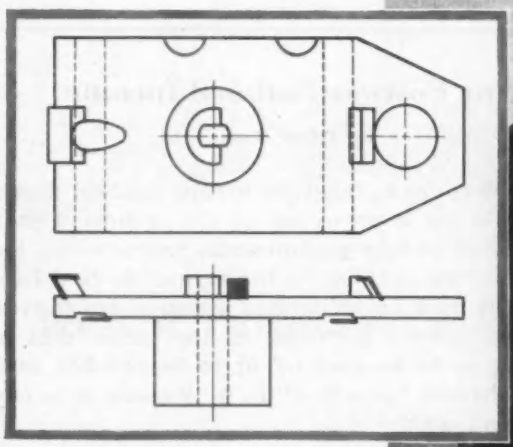
A HAPPY-GO-LUCKY attitude toward national finance may be set down as one of the prominent characteristics of leading governmental functionaries and their fellow-travelers during the days of the New Deal. Inherent in such an attitude is a disposition to treat cautioning against increases in the public debt as something to be laughed off or to be brushed aside with a frivolous "So what?" or a "We owe it to ourselves, don't we?"

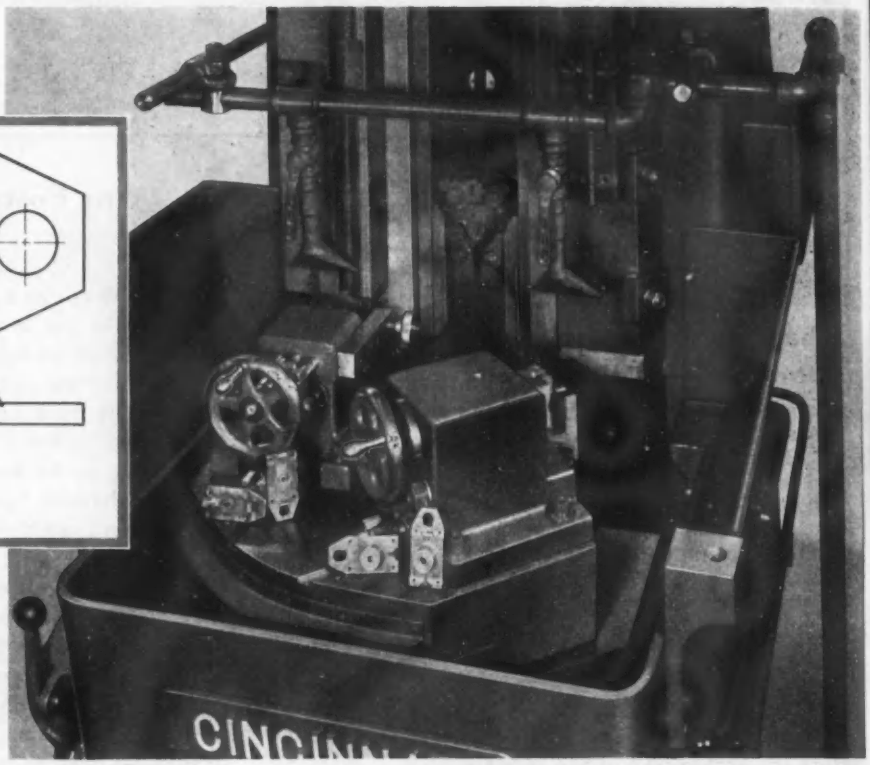
During the past year or so, however, there has been manifested among those who have been in positions of political prominence and power a growing interest in and an increasing concern over that variously estimated something which we call our national income. They seem to have realized belatedly that national income has quite a bit to do with our capacity to provide jobs, to pay taxes, and to reduce our grossly swollen debt. Some of them have made obviously over-optimistic if not extravagant predictions as to the heights our national income may reach in the early postwar period. These chameleonesque present-day preachers of national fecundity, disregarding the restricted and governmentally hampered accomplishments of New Deal days, are now flushed with the reflected brilliance of industry's production record during these days of war.

As a recently converted advocate of an economy of abundance, Henry Wallace has said, without being too specific about what method of calculating national income he was employing, that, "If we go up to 200 billions, as we can go, we could carry the debt load that much more easily." Other estimates from other sources have ranged from 100 billions to 240 billions or from one and one-half to over three times our prewar level.

The Brookings Institution has lately published the results of studies of the probable magnitude of the national income in the first reasonably settled postwar year which, it is assumed, will be 1947. For that year, the report indicates a national income of 123.1 billions as against 147.9 billions in 1943 or a decrease, not an increase, of approximately 17 per cent. And that is something for our law makers to think about from several points of view, retrospectively with regret over profligate spending, prospectively with hope that through active fostering of the American system of enterprise this prophecy may eventually be shown to have been too conservative.

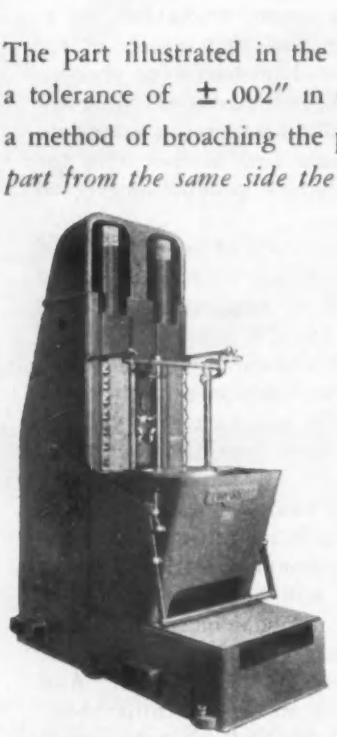
holding a ±.002 *tolerance*





from an UNFINISHED SURFACE

The part illustrated in the drawing above presented several problems, not the least of which was to hold a tolerance of ± .002″ in the depth of shallow slots. CINCINNATI Application Engineers worked out a method of broaching the part on a No. 3-48 Duplex Hydro-Broach, with unique fixtures which *locate the part from the same side the cut is taken,* assuring the required accuracy.



CINCINNATI No. 5-42 Duplex Hydro-Broach Machine. Brief description may be found in Sweets Catalog File. Complete specifications may be obtained by writing for catalog No. M-894-2.

In the right-hand fixture, the lugs and center boss on one side are broached to a height tolerance of $^{+\ .000}_{-\ .000}$″. Then the part is transferred to the left-hand fixture where two shallow slots are broached to a tolerance of ± .002″, measured from the unfinished surface. Thus one part is completed each cycle of the machine, and production averages 160 parts per hour.

Perhaps many components of your new and proposed products could be finished more economically on CINCINNATI Hydro-Broach Machines. Our engineers will be glad to analyze your requirements. Write for full information, enclosing prints of the parts.

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

November 1, 1944
Volume 91, No. 9

What Happened to the French Automobile Industry

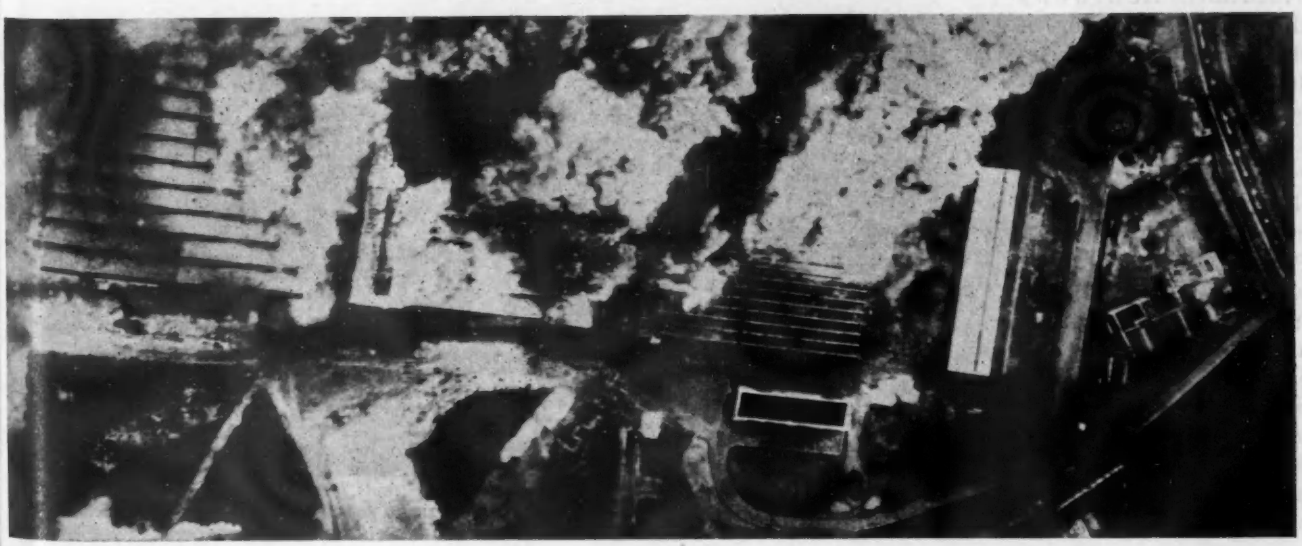
AFTER nine months of war and 50 months of German occupation, the French automotive industry is dead. It will be revived, but the date of its resurrection depends considerably on the United States and England. At the present time not a single automobile factory is in operation. Many of them have been closed since May.

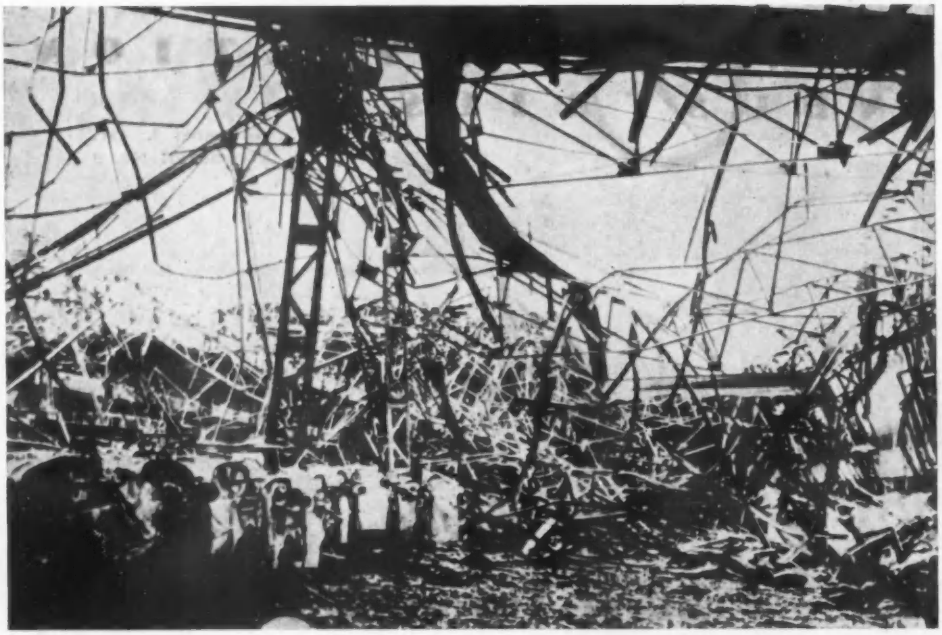
The works completely or partially destroyed by bombing comprise Goodrich, Dunlop and Michelin tire factories; Renault, Ford, Berliet, S.K.F. and S.R.O. ball bearing works, Standard Oil Company's refineries, Castrol oil works, Potez, Farman, Salmson, Caudron and Gnome & Rhone aircraft factories. Peugeot was bombed by the English and the foundry wiped out. Citroen was attacked by the Germans in June, 1940, the fires then started destroying documents, but leaving the main works intact.

Within a few weeks of the capture of Paris the Germans founded the C.O.A. (Comité de l'Organization de l'Automobile) based on the German law of Aug. 16, 1940, dealing with industrial production. At the same time all existing trade organizations

THE author of this article is a thoroughly competent and experienced automotive specialist who has spent the greater part of his life in France. He has long been recognized as an authority on the automobile industry there. From personal observation and first-hand knowledge, he relates here what took place in France with respect to its automobile industry during nine months of war and more than four years of German occupation. He describes the present state of the industry, and comments briefly on its prospects for recovery.

Here is a picture taken during the raid in the Renault works at Le Mans. Note the smoke pouring from the three large plant units.





The Renault plant was effectively knocked out by Allied bombers. This was scene of truck production for the Nazi army on the Ile Seguin and had formerly produced touring cars. Note the rows of trucks that were ready for delivery.

were abolished. According to the official decree, the five objects of the C.O.A. were:

1. To take a census of manufacturing organizations, their stocks and means of production.

2. To establish manufacturing programs for motor vehicles, bicycles and their accessories.

3. To organize purchasing and distribution of raw materials and finished products for this manufacturing program.

4. To fix rules for these factories, covering quality, labor, and the regulation of competition.

5. To propose to the competent authorities prices for these products and for services.

François Lehideux, Renault official, was placed at the head of the C.O.A., and for a time was also Minister of Industrial Production. Lehideux thus became dictator of the French automobile industry, responsible directly to Adolf Hitler, and that industry was switched over to supply Germany's war needs. Almost immediately after Paris was freed Lehideux was arrested and thrown into La Santé prison, on a charge of assisting the enemy. His defense appears to be that he tried to hold the automobile industry together and to prevent French workers being sent into Germany.

Every automobile manufacturer, every repair shop, every owner of a wayside gasoline station had to belong to the C.O.A. No supplies could be obtained except through this organization, and every industrialist had to accept the orders given by Germany, or risk deportation and the confiscation of his factory. If it was impossible to avoid working for the Germans, there were degrees of assistance. In some cases it was known that the management sought to increase production, while in others there was systematic obstruction which held production down to very low levels. Now that the enemy has gone, there is much recriminating, some political passion, and some arrests which may not prove to be justified. Among the arrested are Col. Jean Petavy, general manager of the Dunlop tire company, together with other members of the staff, also Jean Berliet, of the Berliet automobile company at Lyons. One of the members of the Michelin factory was imprisoned by the Germans and M. Englebert, tire manufacturer at Liège, was jailed at Antwerp for failing to keep production up to program.

That the main object of the C.O.A. was to intensify production of motor vehicles for the German Army is shown by the official statement in explanation of the law of Aug. 16 and the decree of Sept. 30, 1940, which said:

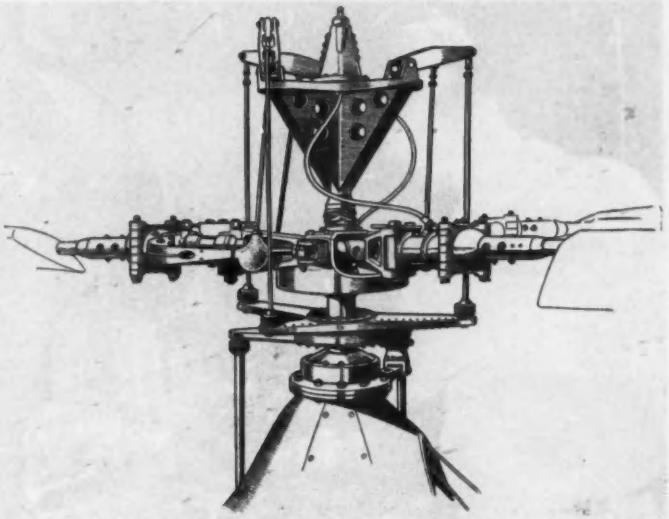
(*Turn to page* 96, *please*)

Here the bombers have interrupted the German supply of crankshafts, valves and motors for automotive and aero war machines.

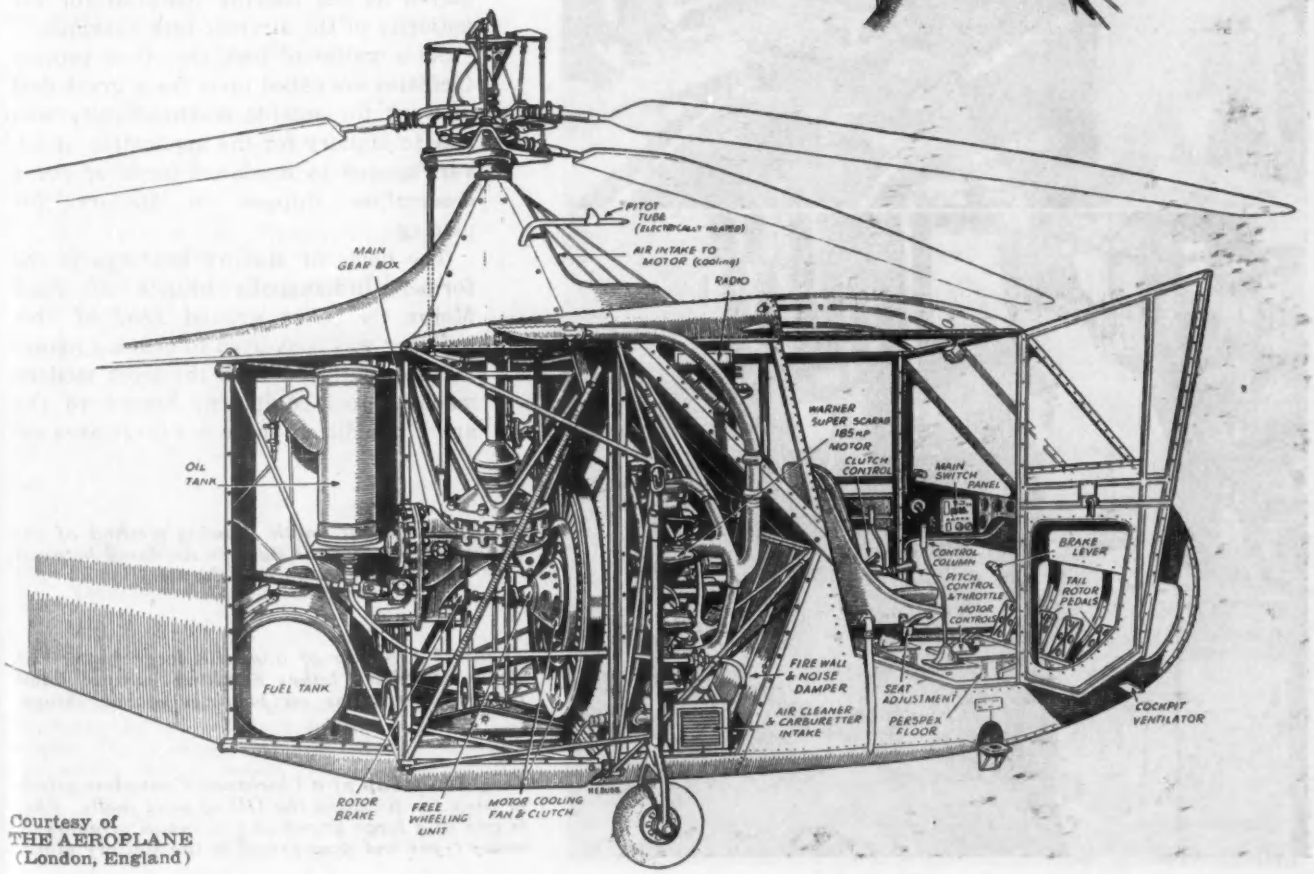
Sikorsky YR-4 Helicopter

Powered by one 175 hp. Warner Super Scarab Motor

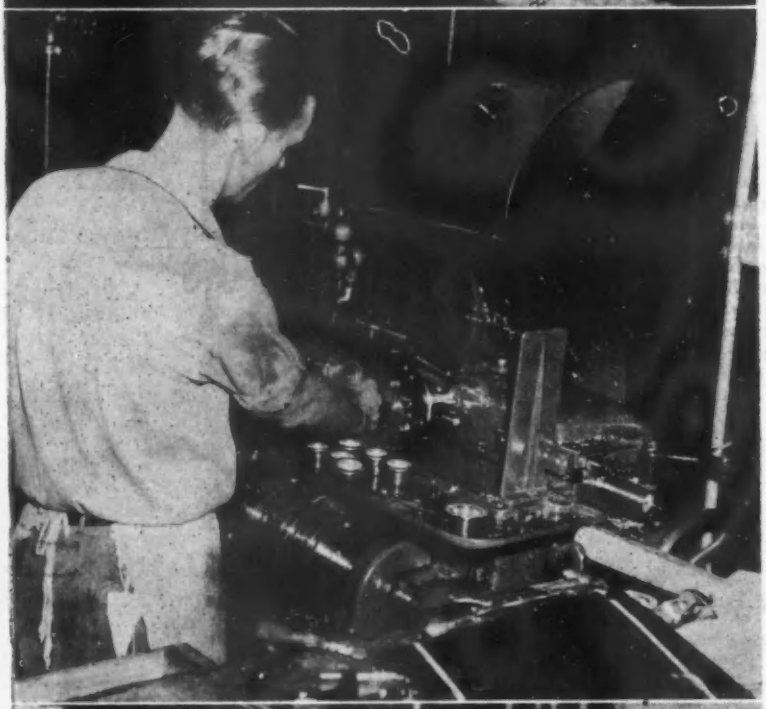
TAIL ROTOR—(Left)—The mounting of the tail rotor used for torque regulation as well as directional control. The shaft is carried by bearings mounted in flexible "slings," giving a certain amount of "play" up and down and from side to side.



MAIN MOTOR HEAD—(Right)—The simple and straightforward main rotor head is shown mounted on a metal pylon of four steel tubes. The main mounting shaft is surmounted by an oil reservoir with leads to rotor couplings. The transmission of control can be traced through a plate acting as a face cam and another in the form of a three-point star which rotates and controls the four movements of the rotors and the pitch of the blades. Dust caps can be seen at the bottom of the upper control rods and at the tops of the lower rods.



Courtesy of
THE AEROPLANE
(London, England)



Silver

RICHLY endowed as a metallurgical specialist, P. R. Mallory & Co., Inc., has served the industry for many years, particularly in the field of the rare metals, in powder metallurgy, and in special analyses such as the hardenable copper alloys developed for resistance welding electrodes. Among other things, the organization has gained recognition for its work with tungsten and silver and in their adaptations to automotive uses.

It was only natural, therefore, that the Armed Forces should turn to Mallory for assistance in the production of silver bearings for aircraft engines at a critical time when the demands of the war exceeded existing facilities. With this undertaking came the commercial development of the Mallory line of bearings. Mallory's scientific background in the utilization of silver contributed importantly to the quality of the bearings produced here; and provided unique techniques for the bonding of silver to other metals, particularly to steel which is employed as the backing material for the majority of the aircraft type bearings.

As a matter of fact, the silver process facilities are called upon for a great deal of work for outside manufacturers who look to Mallory for the application of silver, bonded to machined parts of every description shipped to Mallory for plating.

The home of Mallory bearings is the former Indianapolis branch of Ford Motor Co. The ground floor of this building was converted to bearing manufacture, outfitted with the most modern machine tool equipment known to the art. In addition, there is a large area set

(Top) Blacklight booth showing method of examining a bearing for flaws in the bond between the silver coating and the steel back.

(Center) Close-up of one of a large battery of Brown & Sharp lathes handling various detail turning operations on bearings and bushings.

(Left) Close-up of a Cincinnati Centerless grinder used for finishing the OD of steel shells. This is one of a large group of Cincinnati grinders of many types and sizes found in the Mallory plant.

Bearings *Precision Made by* Mallory

By Joseph Geschelin

apart for the electroplating process for silver as well as lead-Indium coatings. Currently the plant is producing some 57 varieties of bearings, implying a production setup which is a mixture of straight line mass production and job-lot production. In addition, some 16 new items are being tooled for production release in the near future.

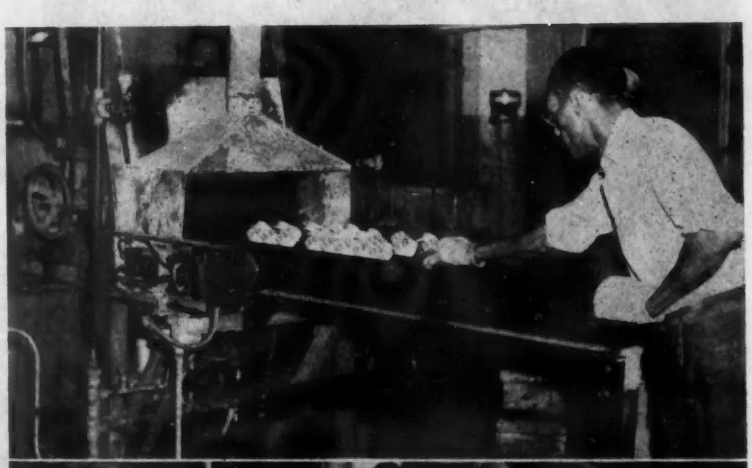
Viewed from the standpoint of quality there is probably no other item of war production that relies upon high standards of precision more than does the aircraft engine bearing. These thin-wall, steel-back bearings carry enormous loads with unit loading far exceeding normal automotive practice. Fits must be perfect and the bond between the silver and the back must be absolutely right. Quality control, therefore, is one of the major activities in the plant.

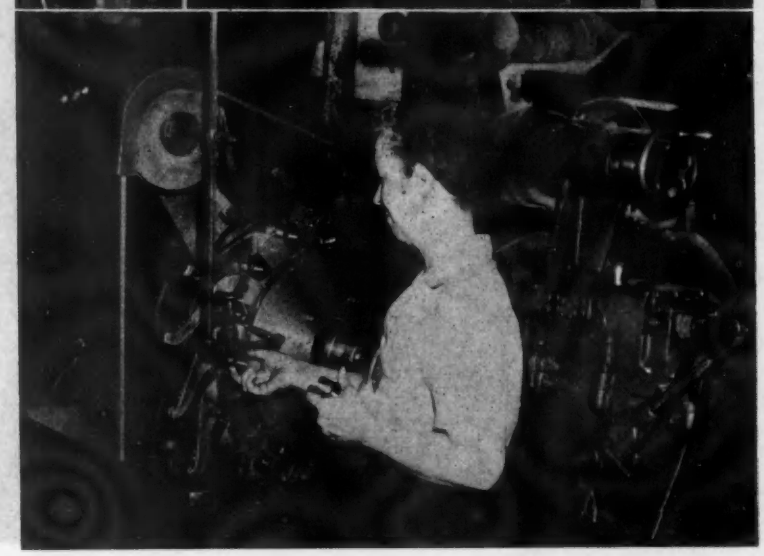
Although Mallory employs the most modern techniques for testing silver bond—the X-ray, and the Blacklight—greatest reliance is placed upon a mechanical test—the chisel test. Since this is in the nature of a destructive method applied 100 per cent, all bearings subject to this test are designed so as to provide areas on which the chisel can be applied. Later, these excess surfaces are machined off. In some instances, it has been found necessary to redesign and retool bearings already in production so as to afford an application of this test method.

Some of the metal cutting techniques are of special interest. For example, practically all metal removal on the steel blanks is done with special steel cutting grades of cemented-carbide tools.

Precision grinding equipment consisting of external and internal, surface and centerless machines are widely used, where applicable. With certain types of blanks both the OD and ID are ground in centerless type machines; however, no grinding operations are performed in finishing silver surfaces. Mallory has found that the diamond is the most satisfactory tool to produce the extremely fine finish required on the bearing surfaces. Final finishing of outside and inside diameters and faces coated with silver is done on special Heald Bore-Matics, which are used widely

This is the Ninety-ninth in the series of monthly production features





(Top) One end of the long General Electric heat test furnace through which all bearings are processed following silver plating.

(Right) Close-up of a unique surface grinder developed by Besly for grinding bushings to length. The bushings are inserted into the fingers of the central fixture and are clamped securely as they approach the wheel head. Clamping is accomplished by the wrapping action of the cable which engages the groove in the outer end of the fingers.

Bearing Half Shell Routing

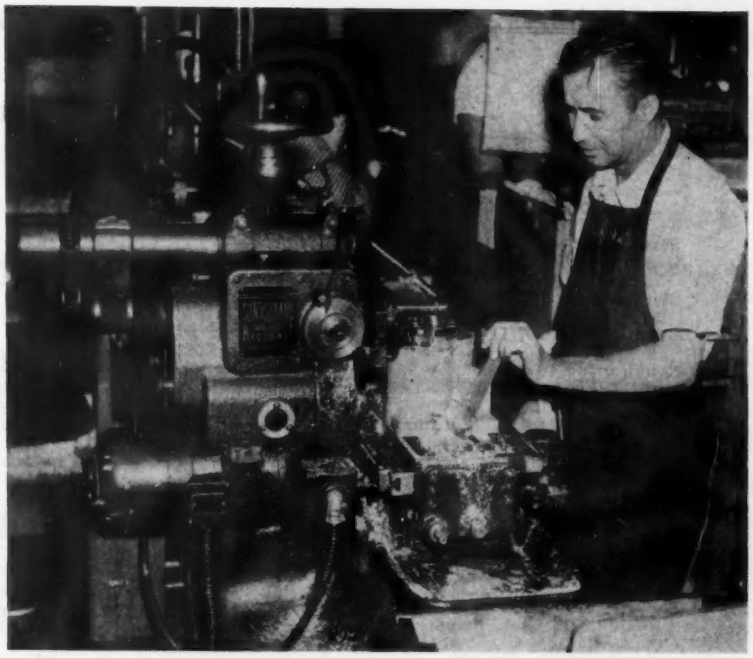
OPERATION	EQUIPMENT	OPERATION	EQUIPMENT
Plate strip stock and roll to specified thickness	Process	Chamfer OD corners	Lo-Swing IMP lathe
Cutoff and rough form	Bliss press	Mill oil groove	Brown & Sharpe mill
Finish form	Bliss press	Finish grind ends	#33 Heald surface grinder
Reform	Bliss press	Drill and ream dowel & oil holes	Drill press
Face both ends and chamfer corners	Oster hand screw machine	Finish grind OD in pairs	10″ Norton external grinder
Rough grind both ends	#33 Heald surface grinder	Finish burr	Bench
Rough mill split line to remove excess stock	#1 Sundstrand mill	Finish grind split line 1.5950-1.5945.	#5 Brown & Sharpe surface grinder
Semi-finish broach split line	Colonial broach	Finish bore ID 0.2215-0.2225 total wall thickness under 3500# pressure	#47 Heald Bore-Matic
Rough grind OD in pairs	10″ Norton external grinder	Bore split line relief	#47 Heald Bore-Matic
Rough bore & chamfer ID in pairs	#47 Heald Bore-Matic	Blacklight test	
		Final inspection	

throughout this plant to produce the precision and fine finish required on these bearings. Surface broaching is employed for the finishing of parting lines of half round bearings and for end splining operations. Special tooth forms, similar to gear teeth, are shaped on Fellows gear shapers, then shaved for form and finish on Red Ring shaving machines.

At this point it may be well to sketch briefly the generalized picture of the production setup. The line of bearings varies in range and type and size and is produced from bar stock, tubing, and forgings. Several types of strip bearings of automotive type also are made and these are fabricated from coated strip stock supplied by another Mallory division. Starting point for most operations, therefore, is the screw machine department. Here will be found familiar items of equipment, such as Cleveland Automatics, several huge six-spindle Conomatics; and a battery of six-spindle Greenlee Automatics. This equipment starts the manufacture of the bearing blanks that are produced from tubing and bar stock. Also in this department is a large battery of Warner & Swasey, International and Gisholt turret lathes; also a large battery of Sundstrand stub

(Top) Glimpses of a part of the final inspection department. Bearings are checked visually for flaws; and dimensionally with the use of precision gages.

(Left) One of many Norton grinders in this plant, this machine handles the grinding of the OD of a bearing blank.



Part of a battery of small Sundstrand Rigidmills which do all manner of jobs including the cutting of serrations as shown here.

lathes and Lo-Swing IMP lathes. This equipment is used to produce blanks from steel forgings and stampings.

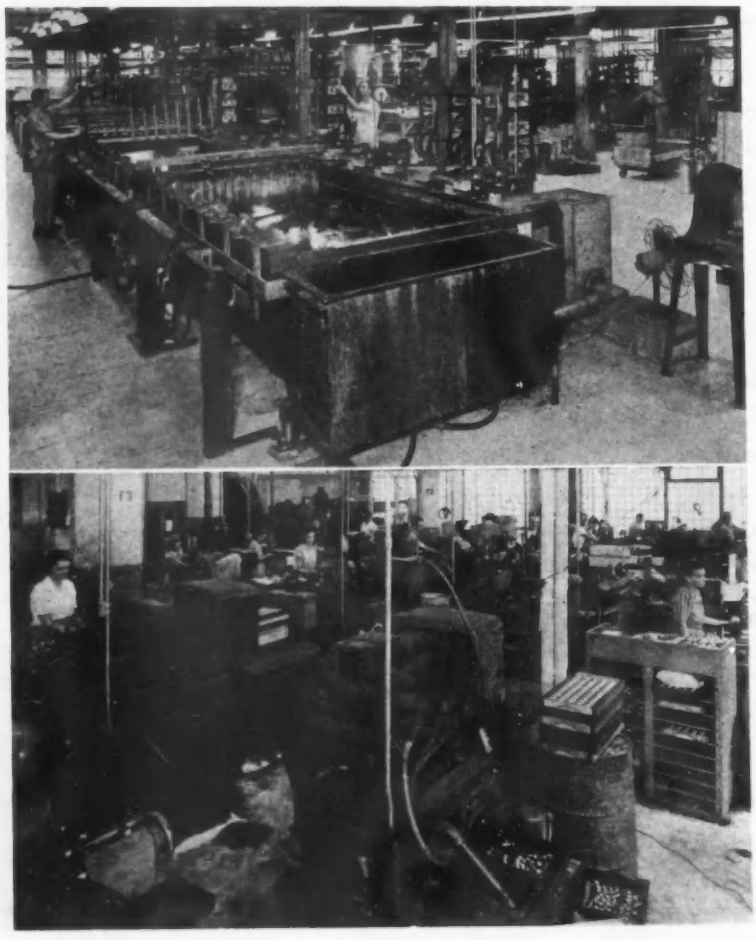
After passing through this point, the blanks are spot-checked and routed to the grinding departments. Grinding equipment includes almost every type and make of fine grinders on the market; Cincinnati external grinders, Cincinnati Centerless grinders, Heald internal and rotary grinders, Arter rotary grinders, Norton cylindrical grinders, Brown & Sharpe grinders. In addition, there is a familiar Sunnen small-hole honing machine. This group also boasts a special Besly grinder used for finishing the

Counterbalance Bearing Routing

OPERATION	EQUIPMENT
Purchase forging annealed, normalized, sandblasted	
Stamp code on flange end. Chuck on OD. Rough bore I.D 4.253-4.243. Face small end. Clean up cut. Chamfer ID small end	Warner & Swasey turret lathe
Chuck in ID. Face flange to O.A.L. — 2.140-2.130. Rough flange OD 5.500-5.515. Chamfer ID & OD	Warner & Swasey turret lathe
Turn body OD 4.922-4.912. Turn flange OD 5.465-5.445. Face small end 2.117-2.123 O.A.L. Face back of flange .230-220 tk. Chamfer OD corners	Sundstrand stub lathe
Heat treat	Furnace
Sandblast	Bench
Spot check 10% for hardness	
Chuck on OD. Face flange .195-.191 tk. Bore ID 4.305-4.303. Turn flange OD 5.402-5.399	Warner & Swasey turret lathe
Turn body OD 4.858-4.856. Face back of flange .160-.156. Face end O.A.L. 2.060-2.056. Chamfer OD.	Sundstrand automatic lathe
Chamfer ID small end	Warner & Swasey turret lathe
Inspect small end face. 100% for hardness	
Grind small end face O.A.L. 2.054-2.051	Heald grinder
Grind flange face O.A.L. 2.049-2.047	Heald grinder
Grind ID 4.313-4.314	Heald grinder
Grind body OD and back of flange body OD 4.841-4.839 dia. and concentric with ID within 0.004	Norton grinder. Live headstock
Silver plate OD .030 min. Ag. wall. 4.9015 min. Ag. dia.	Process
Inspect silver	Bench
Heat test 325 F. for 3 hours	Furnace
Clean excess Ag. from flange face and ID	Bench
Rough turn silver OD 4.875-4.873 dia. Turn flange dia. Clean up cut, 5.392-5.394 dia. Face back of flange .148-.145. Groove back of flange. Face small end 1.997-1,995 O.A.L. Chamfer OD corners	Sundstrand stub lathe
Face back of flange .143-141. Neck back of flange .025-.035 D.P.	Monarch lathe
Blacklight test	
Grind small end O.A.L. 1.983-1.984	Heald grinder
Grind flange face flange tk. .137-.138	Heald grinder
Regrind ID 4.318-4.319	Heald grinder
Rough broach	Colonial horizontal broach
Finish broach	Colonial horizontal broach
Rough burr splines—small end only	Bench
Drill 6—.0625 dia. holes in OD	Avey drill press
Countersink 6—.0625 dia. holes on OD	Avey drill press
Chamfer ID splines, both ends. Chamfer OD small end. Radius OD corners	Monarch lathe
Grind OD of flange 5.377-5.373 dia.	Norton grinder
Finish grind flange face, flange tk. .135-.136	Heald grinder
Finish grind small end. To finish O.A.L. 1.9795-1.9785. Parallel with flange face within .0004 T.I.R. Check for flatness	Heald grinder
Grind back of flange and undercut length from back of flange to end of bearings 1.846-1.848. Undercut	Brown & Sharpe universal grinder
Rough turn OD silver 4.8681-4.8671 dia.	Heald Bore-Matic
Inspect complete by production	Bench
Magnaflux for defects	Magnaflux
Finish turn body OD 4.8645-4.8635 dia. square with back of flange and concentric with ID within .002 T.I.R.	Heald Bore-Matic
Final inspection	Bench
Stamp or etch permanent heat code, etch date and identification symbol	

Supercharger Bushing Routing

OPERATION	EQUIPMENT
Screw machine blank	3¼ Conomatic
Grind small end O.A.L. 1.300-1.298	#22 Heald Rotary
Grind flange face O.A.L. 1.294-1.296	#22 Heald Rotary
Grind ID to 1.587-1.588	#81 Heald or #72 Heald Bore-Matic
Rough grind OD of body & back of flange. OD 1.830-1.831. Flang tk. 0.126-0.1275	6 in. Norton or Cincinnati External Grinder
Silver plate ID & face of flange. Max. ID silver 1.534. Min. flange tk. including steel 0.155	Process
Heat test 60 minutes—940 F-960 F	Furnace
Chisel test for bond	
Rough & finish bore. Turn flange OD. Face flange. Radius OD flange face. Chamfer ID flange end	#2 Brown & Sharpe Automatic
Face small end 1.256-1.258. Radius OD back flange 0.005 max. Radius OD body 0.005 max.	Lo-Swing Imp lathe
Blacklight test	
Finish grind OD body & back of flange OD.	#6 Norton #10 Landis Cincinnati external grinder
Inspect	
Silver plate OD & back of flange. OD 1.880 min. Ag. Flange tk. 0.175 min. Ag. & inspect silver plate	Process
Heat test for 1 hour 940 F-960 F	Furnace
Chisel test for bond	
Rough turn OD body. Finish turn OD flange. Face back of flange. Face small end & chamfer	Lo-Swing Imp lathe
Blacklight test	
Turn OD body. Face back of flange. Face end. Neck at 45 deg. Chamfer ID & OD body. Chamfer OD back of flange	#2 Brown & Sharpe Automatic
Drill 3 holes equally spaced 1/16 dia. & located .440-.450 from flange face	Drill press
Skim bore ID 1.543-1.544. Chamfer ID flange end. Cut oil groove. Chamfer flange OD	#2 Brown & Sharpe Automatic
Finish turn OD body & straddle face flange	Heald 47A
Mill 6 grooves in flange face	Sundstrand Rigidmill
Finish bore ID. Chamfer. Radius & burr oil holes on ID	Heald Drill
Blend and polish flange & chamfer & visual inspect	
Lap and blue	
Inspect	
Lead indium .0005-.0008 tk.	Process
Inspect	



face and length of supercharger bearing blanks. Feature of this double-head machine is the application of a disc-type fixture into which blanks are loaded continuously without stopping. The work is held securely in place by a unique device. Each station has a flexible spring arrangement which is tightened in place by the wrapping action of a steel cable just before each station reaches the wheel head.

Upon completion of the grinding operations, the blanks are routed to the blank inspection department, thence to the process department for silver plating. When the inspected pieces reach the process department they are carefully weighed and sorted since the weight of the steel becomes a function of the electroplating process.

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(Top) General view in the silver plating department—one of the major activities in the plant.

(Left) Perspective view in the short-order department. In the foreground are several Heald Bore-Matics employed in the cam-boring of bushings and bearings. Similar machines are found in other departments of the plant.

Rotol Cabin Supercharger

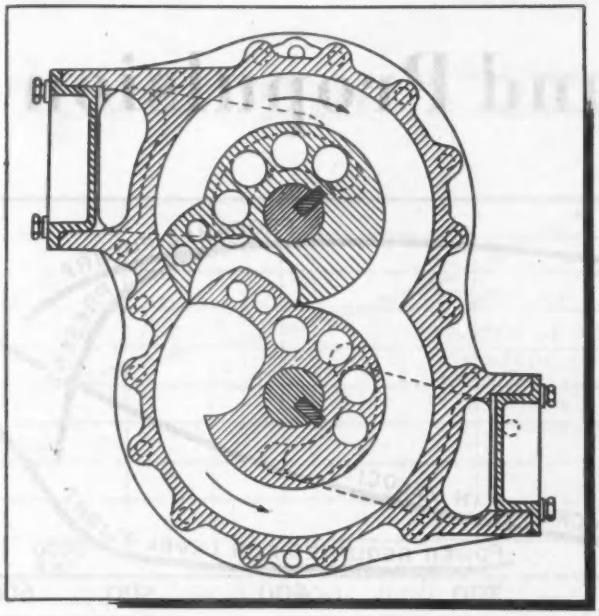

Fig. 1—Transverse section showing the rotors in position for beginning a cycle.

By M. W. Bourdon

Special Correspondent of AUTOMOTIVE *and* AVIATION INDUSTRIES in Great Britain

A PRESSURE-CABIN supercharger to maintain air pressure corresponding with the atmosphere at 10,000 ft at any height up to 40,000 ft has been developed in England by the Rotol Co. The installation effects air-conditioning and maintains the air at a comfortable temperature at all altitudes up to the ceiling of the aircraft. Thus, it removes the need for the occupants of a pressure-cabin to use either oxygen masks or special clothing. On each aircraft used for experiments and tests two superchargers are fitted, it is suggested that, for safety's sake, two should be fitted as a general rule.

In a completely airtight cabin the flow of air is controlled by a valve permitting it to escape at a pre-determined rate. The valve itself is controlled automatically by an aneroid valve, which closes it progressively as altitude increases, and vice versa.

The design of the Rotol supercharger is based upon that of the Northy-Boyce exhauster, which is extensively used, among other purposes, to provide the negative pressure in railroad vacuum braking systems. In an aluminum casing are two inter-geared rotors (Fig. 1) with the minimum of clearance between them and the casing, and between one another at all points of rotation. They are of cylindrical shape, basically, but with the cylindrical surface interrupted by a longitudinal groove

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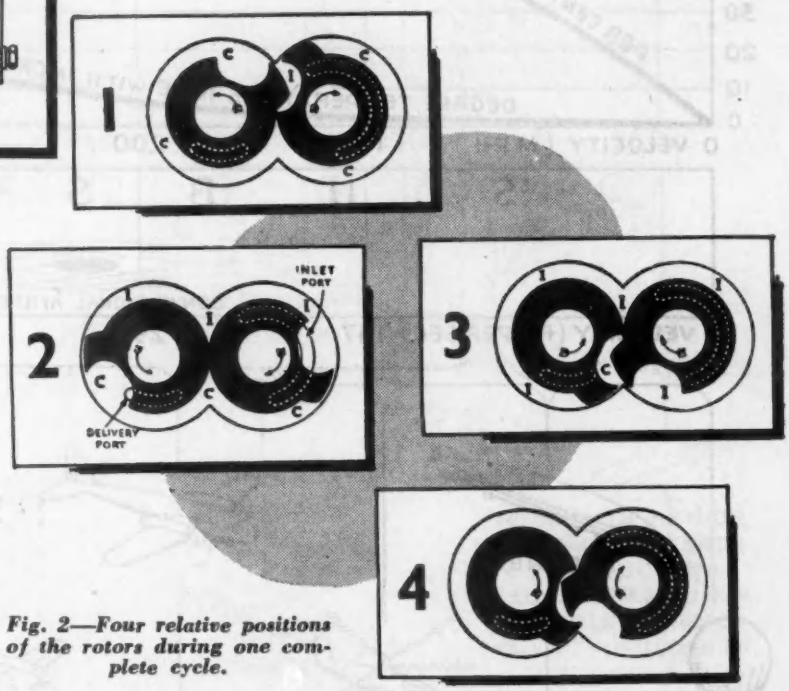


Fig. 2—Four relative positions of the rotors during one complete cycle.

1—Beginning of cycle. (a) Inlet port about to open into induction space "I". (b) Compression beginning in space "C".

2—(a) Induction well advanced in space "I". (b) Delivery beginning from space "C".

3—(a) Induction complete. Inlet port shut off from space "I". (b) Deliver complete.

4—Change-over position. Both ports still closed. Seal broken between rotors, resulting in the residual compressed air in space "C" passing back to the inlet side.

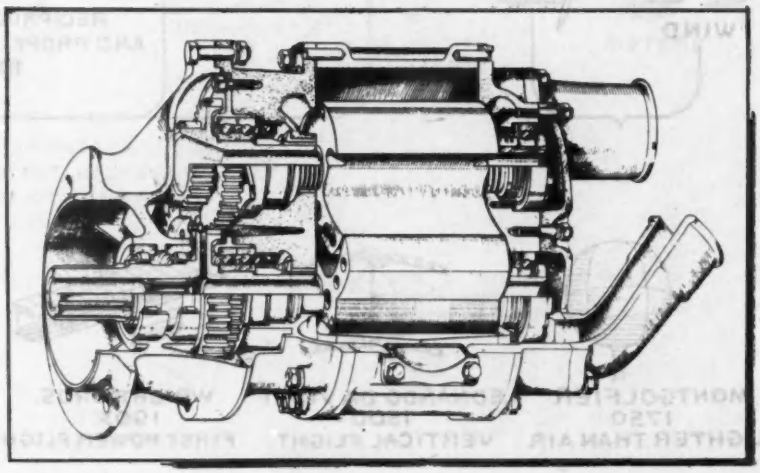
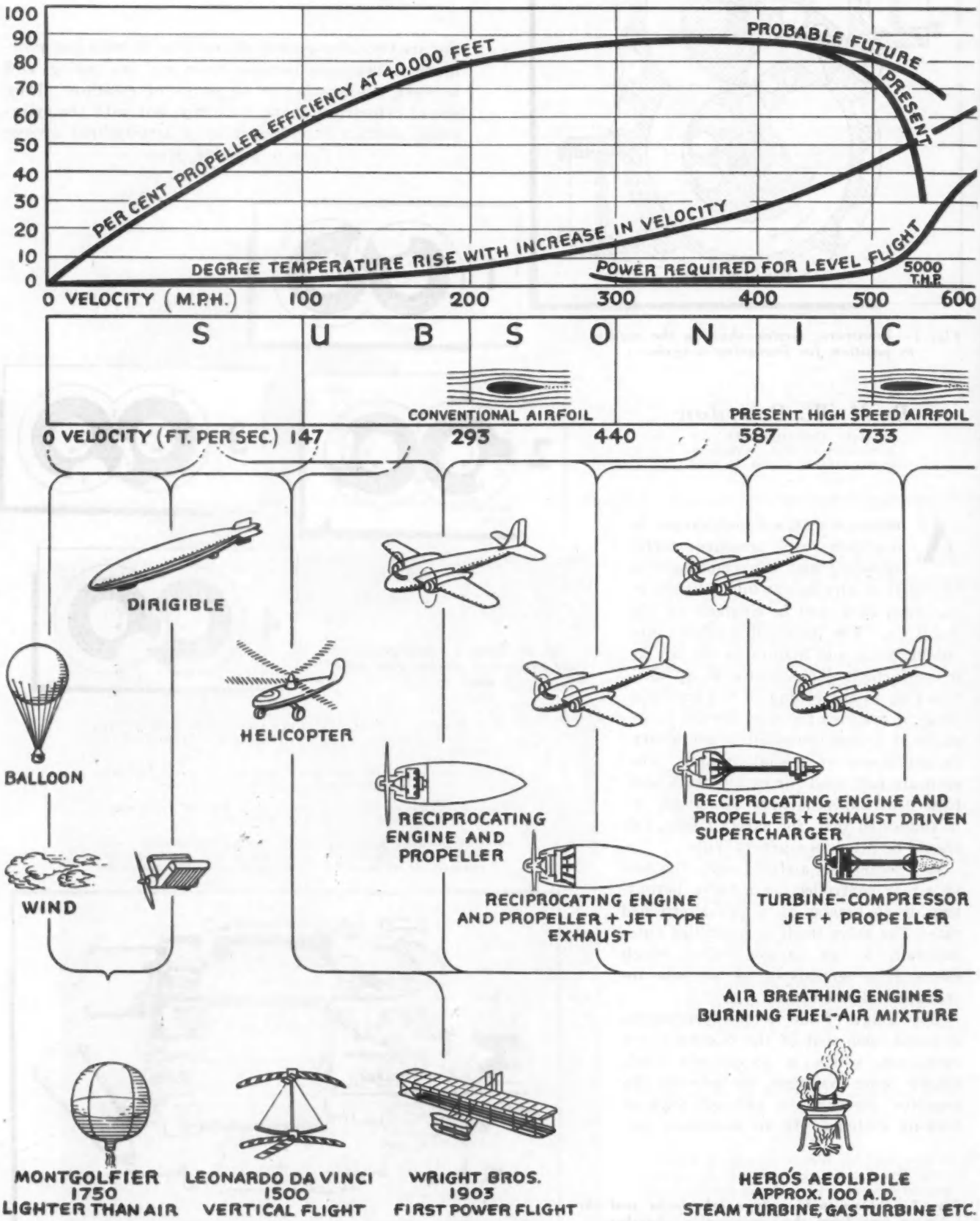


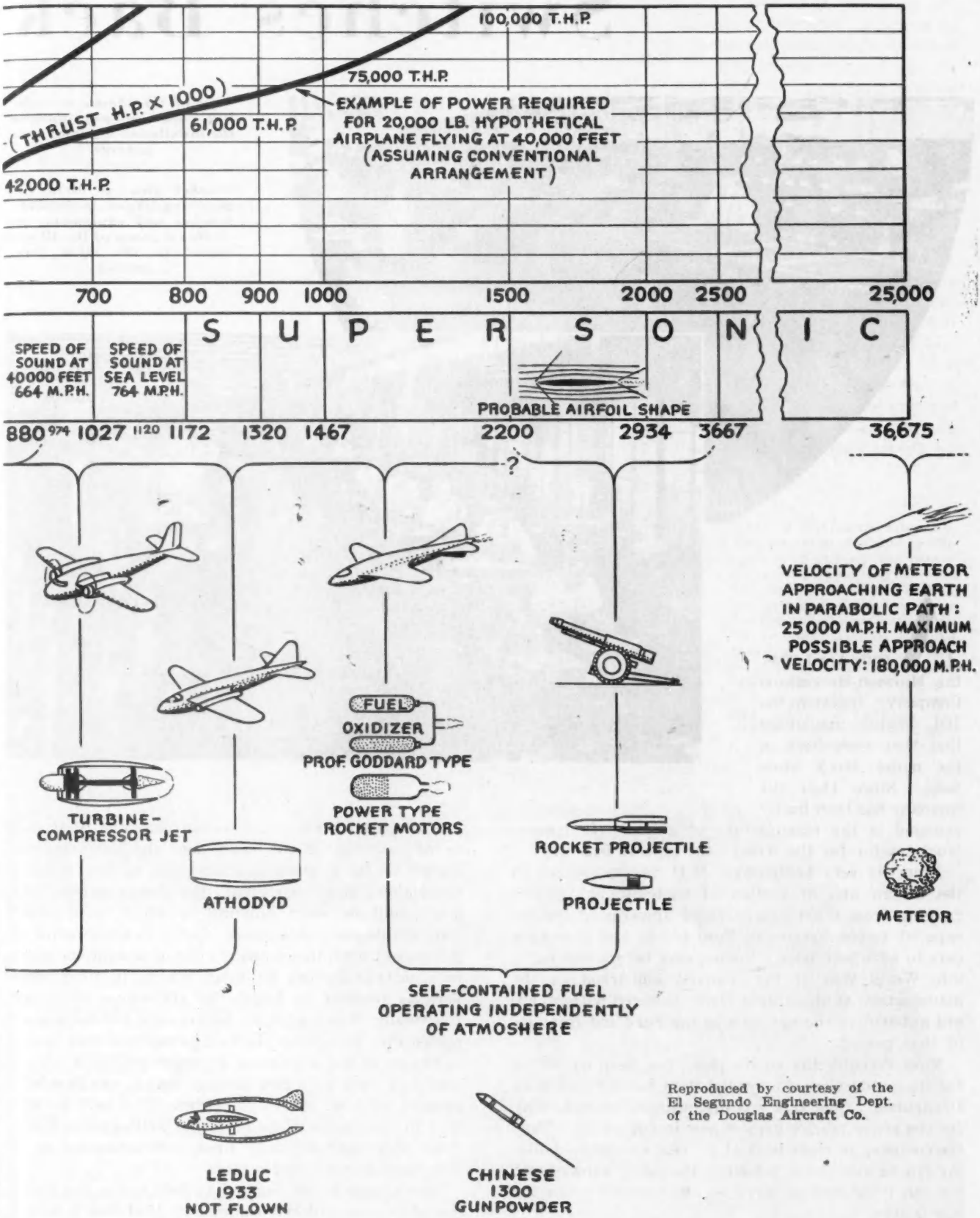
Fig. 3 — Steam-turbine type labryinths seal the gear case from the compression chamber.

Flight and Propulsion



Spectrum

Past and probable future is visualized in the year 1944


100,000 T.H.P.
75,000 T.H.P.
(THRUST H.P. X 1000)
61,000 T.H.P.
42,000 T.H.P.
EXAMPLE OF POWER REQUIRED FOR 20,000 LB. HYPOTHETICAL AIRPLANE FLYING AT 40,000 FEET (ASSUMING CONVENTIONAL ARRANGEMENT)
700 800 900 1000 1500 2000 2500 25,000
SPEED OF SOUND AT 40000 FEET 664 M.P.H.
SPEED OF SOUND AT SEA LEVEL 764 M.P.H.
SUPERSONIC
PROBABLE AIRFOIL SHAPE
880 974 1027 1120 1172 1320 1467 2200 2934 3667 36,675
VELOCITY OF METEOR APPROACHING EARTH IN PARABOLIC PATH: 25000 M.P.H. MAXIMUM POSSIBLE APPROACH VELOCITY: 180,000 M.P.H.
FUEL
OXIDIZER
PROF. GODDARD TYPE
POWER TYPE ROCKET MOTORS
TURBINE-COMPRESSOR JET
ATHODYD
ROCKET PROJECTILE
PROJECTILE
METEOR
SELF-CONTAINED FUEL OPERATING INDEPENDENTLY OF ATMOSHERE
LEDUC 1933 NOT FLOWN
CHINESE 1300 GUNPOWDER

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Marmon-Herrington

Switches Back

View of the chassis assembly line about mid-way, showing the installation of major components.

Another view at Merz Engineering shows toolmakers' benches and equipment, including a group of Do-All machines in the right foreground.

ABOUT April, 1944, the Marmon-Herrington Company, Indianapolis, Ind., happily announced that they were back in the motor truck business. Since then the company has been busily engaged in the manufacture of a heavy four-wheel truck-tractor for the Army—the type H 542-11.

From its very beginnings, M-H has specialized in the design and production of custom-built vehicles ranging from 6 x 6 trucks rated upwards of ten-ton capacity to conversions of Ford trucks and passenger cars to all-wheel drive. Some years before our entry into World War II the company embarked on the manufacture of small light tanks powered with standard automotive engines such as the Ford and Hercules of that period.

More recently the entire plant had been converted for the production of a special item for the Ordnance Department; then this was discontinued to make way for the heavy tractor project now in full swing. Thus the company is right back at its real specialty—building trucks and motor vehicles—the job it knows best; the job it intends to carry on aggressively when the war is over.

A sketchy review of the recent history of M-H may be of interest. Some years ago the business was moved to its present location—site of the original Duesenberg plant. Originally the plant consisted of a large multiple story building to which were added some single-story extensions. Later, in anticipation of Army contracts, the company erected several one-story monitor-type factory buildings which, in time, were perhaps doubled in length by successive additions. Eventually, even the spaces between the buildings were roofed over to further increase productive floor space.

Although this expansion program extended over a period of time, it is now obvious that it was carefully planned with an eye to the future. This will be evident to the visitor as he notes the well organized machine shops and assembly lines, interconnected as if they were under a single roof.

Specializing in the heavy-duty field and in the building of custom tailored equipment, M-H has a layout

By Joseph Geschelin

to Trucks

which lends itself to small-lot production and capable of handling a variety of products. Mechanization has been limited to activities justifying such procedure. Mechanical handling, in the main, is done with the aid of hoists and craneways; and with the use of versatile Automatic Transportation industrial trucks and transporters.

Let us now consider a highspotting of what has been accomplished in switching over to truck production. Taking the plant by departments, we find first the receiving department into which flows raw and finished parts and components from the trucking docks. Next is a self-contained machine shop tooled for the machining of many miscellaneous parts, more particularly the brackets and hangers and other attachments for frame and chassis assembly. Here are found some excellent examples of modern machine tools such as K & T, Milwaukee mills, Bullard V-T-L's, drill presses, W & S turret lathes, etc.

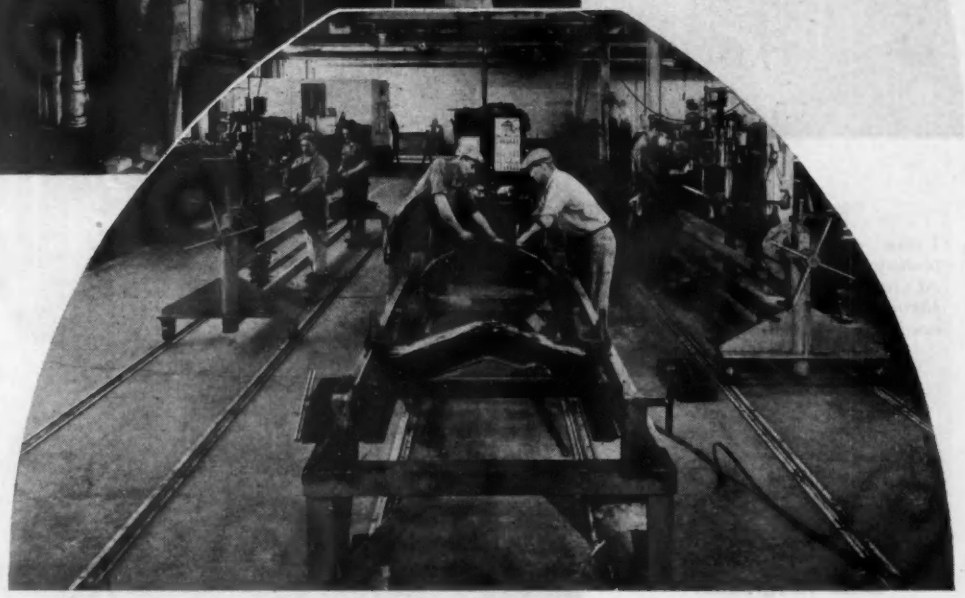
Merz Engineering Co., a subsidiary of Marmon-Herrington, and one of the outstanding tool and precision gage producers in this country, played an important role in the current change-over. Teaming up as a department of the parent plant, Merz designed and built tools, fixtures and gages required for the machine shop operation. This unique facility enabled M-H to start its program without the usual delays incident to a major tooling program.

Adjacent to the machine shop is a small department oufitted for the complete fabrication of wiring harness. Its chief feature is the inclined panel which serves as the assembly and test fixture for wiring harness.

Next is a self-contained department designed for the chemical cleaning of machined parts prior to their movement to the paint and assembly lines. One group is composed of a large Blakeslee Niagara alkali washing machine, a DeVilbiss spray booth, and an infrared lamp station for hastening the baking of the air-drying finish. This entire group is tied together by a small monorail conveyor system. In another section of the department is a small Detrex degreaser unit for cleaning parts heavily coated with grease and oil. Finally, there is a dip tank unit set up for Parkerizing a rather broad variety of small parts.

Another room in

Start of the frame assembly. The trunnion fixtures to the right and left of the center are used for making up side rail sub-assemblies, drilling and reaming fastening holes for the bolted connections. In the center is the massive framing jig in which the side rail and cross member assembly is produced. Note the system of overhead craneways and hoists to facilitate the handling of heavy and bulky parts.



Parts requiring washing, degreasing and painting are processed in this department. In the foreground is a large Blakeslee Niagara washing machine through which many of the parts proceed on the monorail conveyor for washing. The conveyor then carries the work to the spray booth in the background. Drying is by air and ovens equipped with infra-red lamps.

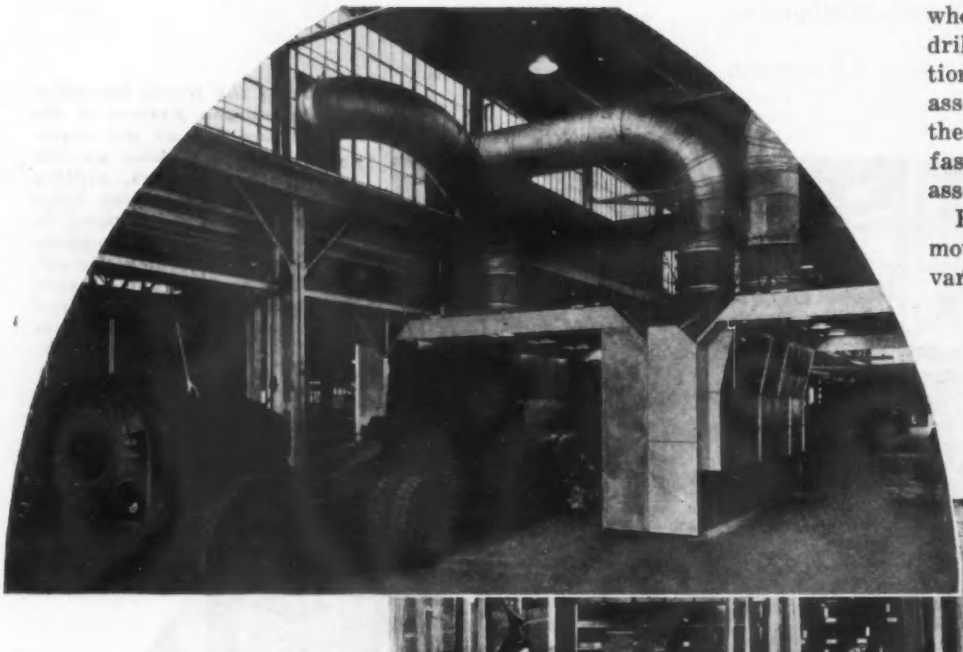
View of one of the machine shop bays in the Merz Engineering plant which serves M-H in the design and fabrication of tools and fixtures. In the foreground at the left may be seen Cincinnati milling machines, K & T Milwaukee mills and Natco multiple spindle drills.

this area is devoted to the fabrication of tube assemblies for air, oil and fuel lines.

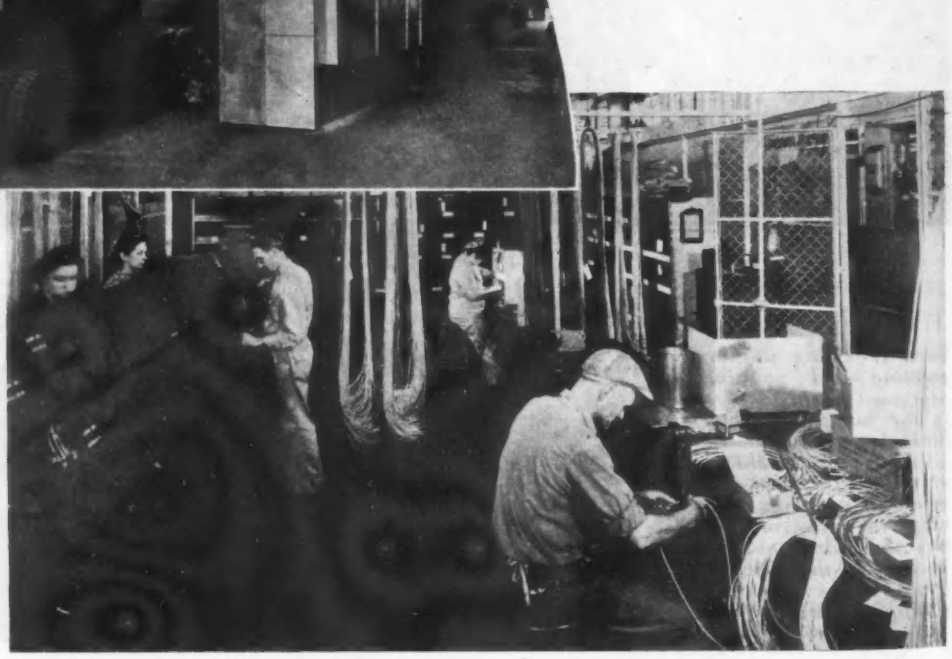
Now we are ready to take a look at the frame assembly of the truck-tractor. Distinguishing feature of this vehicle is the use of a bolted chassis frame—no rivets—with reamed drive-fit holes through the brackets and side rails. Obviously this is done to facilitate disassembly and re-assembly in any theater. Owing to this bolted construction, it was found expedient to treat each side rail as a separate sub-assembly. To this end, a trunnion fixture is provided for the right and left side rails on which the rails are completely assembled and made ready for chassis assembly. The fixtures roll on rails under drill presses in which the holes are drilled and reamed to match mating holes in the frame fittings.

Rail sub-assemblies then are installed rigidly in place in a large steel framing jig to provide accurate alignment of the rails and cross-members. Again, the fixture is movable under drill press stations where the holes are accurately drilled and reamed. Upon completion of these operations, the frame assembly is rolled over to facilitate the reaming of holes and fitting of fastenings to complete the frame assembly.

From this point on the frame moves on its dolly on rails and the various other parts are attached at

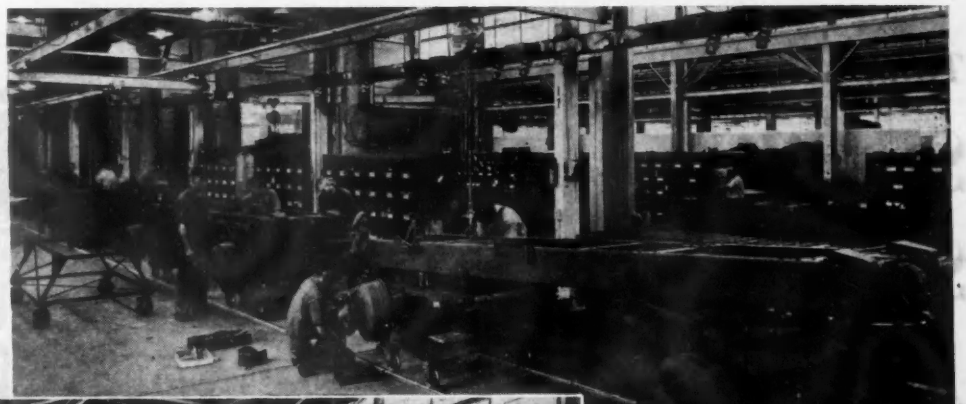


Upon completion of road testing the vehicles are washed and then processed through these huge spray booths for the final painting.

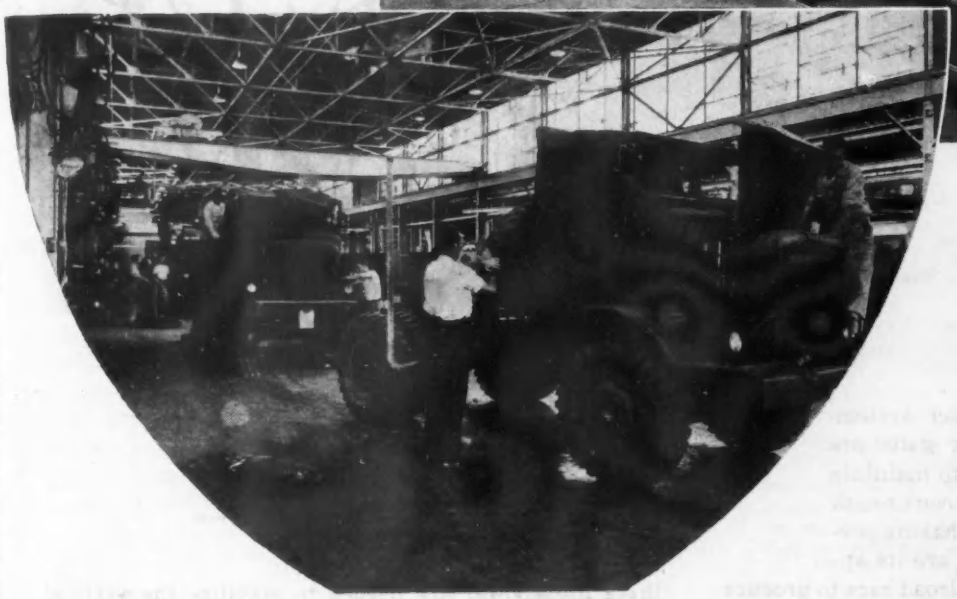


Fabrication and testing of wiring harness is handled in this department. Final assembly and testing of circuits is done on the inclined board in the foreground.

Beginning of the chassis assembly. At this stage the frame is attached to the axles sub-assemblies previously prepared, traveling on rails.



End of the final assembly line at Marmon-Herrington showing one of the heavy truck-tractors ready for the test house.



their respective stations. To this end, sub-assembly stations are established at the point of application. One example of this is the sub-assembly of axles and springs. The frame assembly is then run through one of two large DeVilbiss paint spray booths for the initial coat of paint. These spray booths are served by a self-contained Mechanical Handling Systems monorail conveyor. Upon emerging from the spray booths the frames are ready for final chassis assembly.

The final assembly line is in two sections owing to space limitations which prohibit the use of a single conveyor line. This line has 19 stations from start to finish. In keeping with automotive practice, the final line is served by sub-assembly lines adjacent to the point of application.

Among such stations are the ones for installation of the fifth wheel, tires and wheels, cab assembly, etc. The cab line, which completes the installation of cab fittings, wiring harness, instruments, etc., is arranged in parallel with the final line, the cabs being mounted on special dollies rolling on rails.

When the assembly is completed, the tractors come off the line under their own power and are driven to the test house. Here are made the final adjustments and the vehicles then taken out for the specified road test. Following road test they return to the test house for adjusment, tune-up and any major or minor repairs that may be indicated by the inspector. After the repairs have been made the vehicle is considered as accepted by the Army and is ready for final paint prior to delivery.

The finish paint department, located in another building, contains two huge spray booths, each one large enough to accommodate a complete vehicle. In

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View in the general machine shops with Milwaukee mills and other equipment in the right foreground; American Hole-Wizard radial drills on the left.

Tank Gun

Stabilizer System Adaptable to Cars

By C. R. Hanna, Manager
and L. B. Lynn, Research Engineer,
Electro-Mechanical Dept.
Westinghouse Research Laboratories

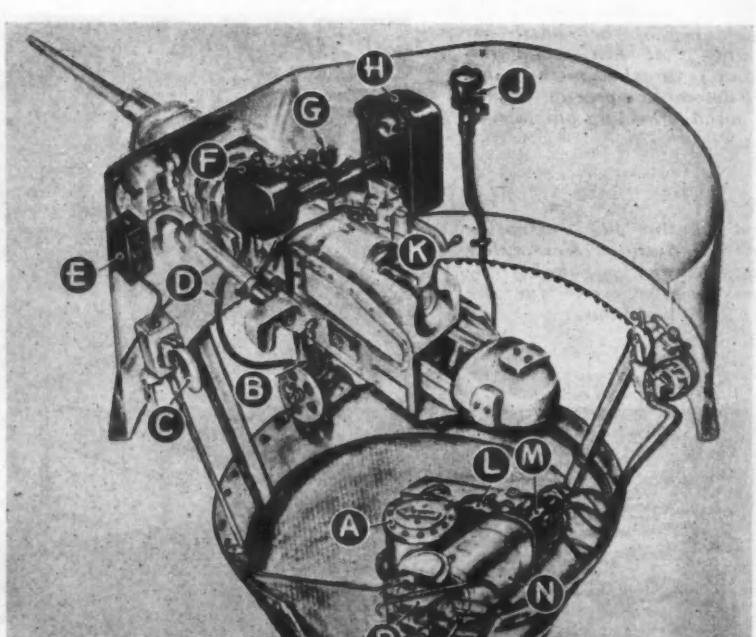


Fig. 1—Installation of the gyro-stabilizer in a tank turret.

A—Turret Collector Ring
B—Disengaging Switch
C—Traversing Control Handle
D—Flexible Shaft
E—Control Box
F—Gear Box and Mounting Bracket
G—Cylinder and Piston
H—Gyro Control
J—Reservoir
K—Recoil Switch
L—Master Switch
M—Oil Pump
N—Electric Motor
P—Hydraulic Traverse Pump

THE electro-hydraulic stabilizer system, with which American tank guns are equipped to enable gunners to maintain an accurate aim while moving over rough battlefields, also shows promise of having several peacetime uses, among which are its application on motor vehicles and railroad cars to produce a "flat" ride. Calculations disclose, for example, that three horsepower are needed to stabilize the vertical movement of a railroad coach. Stabilizer power and size vary as the mass and the square of the fluctuations. Thus, an automobile and railroad car would require units of about the same size since the excessive vertical vibration of an automobile offsets its lightness. Although a tank unit costs about $1000, the requirements of these other applications permit simplification of the design, and together with manufacturing experience gained with the military stabilizer, costs can be reduced considerably.

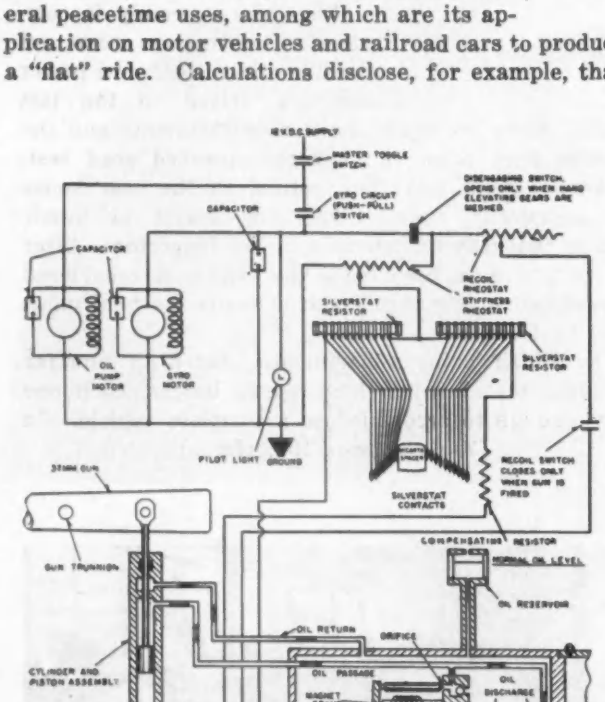


Fig. 2—Cycle of operation for the gun gyro-stabilizer on a light tank.

Holding the gun barrel at the selected elevation regardless of the lurching of the tank, this device makes possible better than 70 per cent hits over a target range of 1200 yards down to 300 yards at tank speeds of approximately 15 mph over rough cross-country terrain. Without the stabilizer, even experienced gunners were unable to score one per cent hits under similar conditions.

The stabilizer system (see Fig. 1) has three major parts—the gyroscopic control unit, an oil pump system including electro-magnetically controlled valves, and the piston and cylinder assembly. The gyro control unit consists principally of a 1/250th hp motor and flywheel, bellows mechanism, and a silverstat regulator. The gyro motor on light tanks is a 12-volt d-c current machine and on medium tanks a 24-volt d-c current unit, operating between 12,500 and 16,000 rpm.

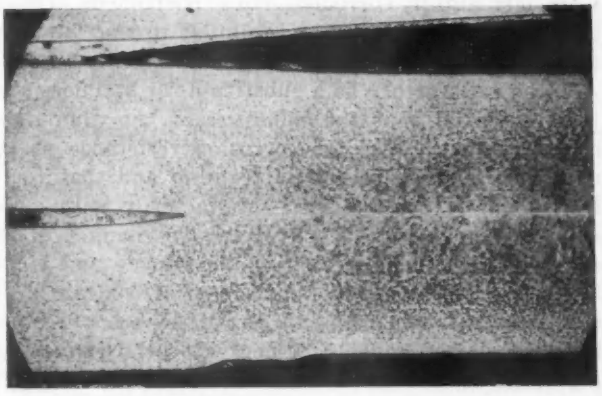
The latest development of the tank gun stabilizer is the mono-gyro control. This system has but a single

(*Turn to page* 150, *please*)

Spotwelding and Forming of Aluminized Steel

By O. A. Moon
Asst. to Vice-President—Engineering;
and F. H. Matthews
Process Engineer, Boeing Aircraft Co.

DURING the dark months of 1942 when the whole aircraft industry was faced with the possibility of a shortage of strategic aluminum and stainless steel, the Boeing Aircraft Co. began to look for suitable substitutes. Should the actual need arise they wanted to be prepared with accurate information on the properties and use of other materials. Many studies on the use of plywoods, plastics and other non-strategic materials were carried out. Among these was an investigation concerning the possibility of spotwelding and forming aluminized steel.



Photomicrograph of a typical 0.035 in.—0.035 in. aluminized steel satisfactory weld. The aluminum-iron bond runs through the center of the weld.

The purpose of this investigation was to determine whether satisfactory welds and welding methods could be developed for spotwelding aluminized steel; to determine the formability of aluminized steel, particularly as to adhesion of the coating under various conditions of forming with a view to its use as a substitute for 18-8 corrosion resistant steel; and to determine whether parts fabricated from aluminum coated steel by spotwelding would have sufficient corrosion resistance.

Photomicrograph of an unsatisfactory 0.035 in. —0.035 in. aluminized steel weld. The slight porosity in the weld metal is caused by too much heat. The protective aluminum coating on the outside has been burned off, and the inside coating has been forced out between the two sheets.

To be a satisfactory substitute for 18-8 stainless steel, aluminized steel should have somewhat the same processing qualities. Spotweld shear strength, quality of weld, formability and corrosion resistance were properties that would have to be considered. Fabrication without new equipment or alteration of the existing equipment, spotwelding without preliminary surface preparation and number of spotwelds that could be made before it became necessary to clean electrodes, would also be determining factors. If a spotwelded assembly in aluminized steel was to be used it would have to be capable of satisfactorily passing the 250 hour salt spray test.

Specific requirements set up for spotwelds were: to replace "stainless steels" of the 18-8 series with aluminized steel, spotwelds in both materials must comply with the same relative requirements as to spot shear

Table I—Minimum spot shear strength required for 18-8 stainless steel and aluminized steel—lb. per spot

Gage — in.	.019	.022	.025	.028	.031	.038	.050	.063	.078
18-8 Stainless Steel	427	515	616	735	867	1238	2000	2840	3746
Aluminized Steel	285	345	412	492	580	825	1340	1900	2500

strength, metallurgical soundness, corrosion resistance, and both practical and economical fabrication.

Aluminized steel shear specimens were spotwelded on standard shop equipment and tested for shear strength, quality, and corrosion resistance by Boeing's metallurgical and inspection laboratories. With normal machine settings the average single spot shear value in annealed aluminized steel was 358 lb for the metal gage combination of 0.19 in. to .019 in. and 927.5 lb for the gage combination .038 in. to .038 in. Using special machine settings it was possible to increase the average single spot shear strength to a maximum value of 533 lb for gage combination .019 in. to .019 in. and 1330 lb for the gage combination .038 in. to .038 in. Tests were also made with 18-8 stainless steel. Average values for 18-8 stainless steel single spot shear specimens were 540 lb for gage combination 0.019 in. and 0.019 in., and 1458 lb for gage combination 0.038 in. and 0.038 in. These results compared favorably with the specified requirements as shown in Table I.

In all cases best specimens were 0.019 in. by $\frac{5}{8}$ in. by 4.0 in. and 0.038 in. by $\frac{3}{4}$ in. by 4.0 in. Material consisted of a very thin aluminum coating on a base of low carbon steel sheet, furnished by American Rolling Mills Co. A mottled surface was characteristic of the 0.019 in. sheet, while the 0.038 in. sheet had a homogeneous appearance, apparently due to a difference in dipping and rolling the finish. In no instance did the surface appearance have a noticeable effect on the forming or spotwelding.

Table I shows the minimum spot shear strength required for annealed 18-8 steels with UTS of 75,000 psi, as specified by Army Air Forces Specification 20011-B. The UTS for aluminized steel is 50,000 psi. The spot shear values in the table for aluminized steel were derived by taking a ratio of the UTS of the two materials and multiplying by the 18-8 shear strengths for corresponding metal gages. These values for aluminized steel were the minimum acceptable, with the further restriction that the loads required to shear any 10 consecutive single spot specimen should not vary more than plus or minus 10 per cent of the average of the 10 specimens.

Note: At the time these tests were conducted no spotweld shear values were listed in the AAF Specification 20011-B for coated steels with ultimate tensile strengths of 50,000 psi; however, revision "C" lists the following required minimum spotweld shear values for steels with UTS below 75,000 psi, coated or uncoated.

Gage—in.	.020	.022	.024	.028	.030	.035	.050	.065	.080
Lb per spot	320	360	410	515	570	750	1400	2080	2700

Results of routine metallurgical examination of spotwelds in aluminized steel indicated that requirements concerning penetration, cracks and porosity, alclad seal and sheet separation, consistency, spitting, and symmetry could be attained with proper machine settings. The photomicrographs show the results of this examination.

Inspection test showed that after 144 hours under a salt spray, slight corrosion products appeared, but did not increase in number or area by the end of 250 hours. The test report concluded by stating that the Alclad protected the steel and that the protective finish is considered satisfactory. It was also noted that the salt spray had a negligible effect on the strength of the spotweld.

Table II—Results of forming operation on Channel Cowl Stiffener, 0.019 in. aluminized steel sheet

Identification Letter	Condition of material as formed	Condition of coating after forming
A	As received cold-greased die	Flaked badly
A	As received slight torch heat	Less flaking but not acceptable
B	Heat treated-formed cold greased die	Slight flaking — slight cracking of coating at bends
B	Heat treated-formed cold-greased die	No flaking — slight cracking of coating at bends
C	Heat treated-formed, slight torch heat	No flaking — slight cracking of coating at bends
C	Heat-treat-greased die slight torch heat	No flaking — slight cracking of coating at bends

A corrosion test by the Boeing Aircraft Co., Renton Division, on a cowl segment made of aluminum coated steel brings out that badly burned spots start to corrode within 2 hours. However, after 250 hours in salt spray test the corrosion had not penetrated sufficiently to materially affect the strength of the part. The aluminum around the spot took most of the corrosion. Although the forming appeared to remove the aluminum from the steel at some of the bends these areas were only slightly corroded. These phenomena brought out that aluminum coating is similar to zinc but more durable than it in protecting the steel.

To be satisfactory as a substitute for stainless steel it is essential that the adhesion of the aluminized coating be such that the corrosion resistance of the material is not impaired by forming and that forming should be accomplished satisfactorily with available equipment and without excessive changes in the equipment. Tensile specimens were made and pulled to destruction to ascertain adhesion of coating in direct tension. Specimens 1.0 in. by 4.0 in. were bent in a brake at an angle of 90 deg with bend radii varying from 1t to 5t both with and across the grain of material. The following Flying Fortress parts were made up and formed on dies:

(1) Channel Cowl Stiffener 0.019 in. sheet (2) Channel Assembly—DZUS Button 0.038 in. sheet (3) Stiffener—Cowling 0.038 in. sheet. Sets of six each were made and two of each sets were marked "A," "B" and "C" for identification. Specimens "A" were formed in "as received" condition. Specimens "B" and "C" were heat treated to 650 F for five minutes and not quenched after heating.

When the tensile specimens were pulled the aluminum coating moved uniformly with the metal base. No flaking was observed at any time. The coating showed surface cracks of small magnitude throughout each tensile piece. These cracks appeared to heal by rapid reoxidation of the aluminum coating.

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Fatigue Strength of Gears

Increased by Special Shaping and Lapping of the Tooth Base

*By M. Ulrich**

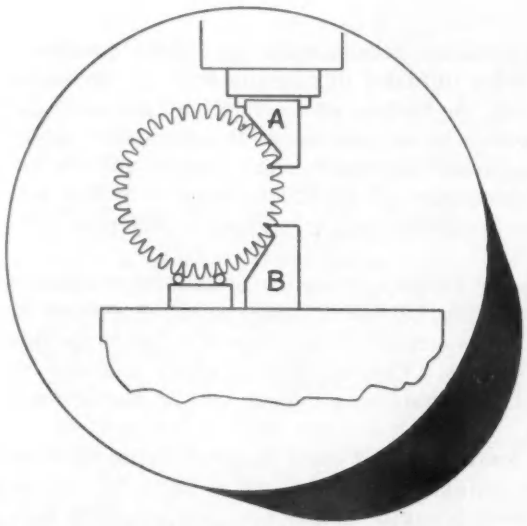

Fig. 1. Apparatus devised for testing the resistance of gear teeth to fatigue fracture.

IN THE first aircraft engine of a large series manufactured before the war, tooth fractures occurred during flight. The marking in the fracture surfaces resembled the annual rings in trees and made it clear that these were fatigue fractures. As the manufacture of new gears would have required considerable time, with the finished series of engines useless meanwhile, it was decided to attempt to increase the fatigue resistance of the gears by special measures.

To obtain a criterion for the amount by which the fatigue dynamic strength should be raised by the projected measures, it was essential first to determine the fatigue strength of the teeth of the gear that had fractured in operation and that of a gear of the same series which had not been in use. The apparatus used for this is shown in Fig. 1. By this means of examination the pulsating bending stress on the teeth is generated by the pressure pieces A and B.

As shown by the dot-dash Wöhler curve A_1 in Fig. 2, the gear that had been in operation survived a pulsating bending force of 6000 kg for a million load cycles; but it failed at 6500 kg. A gear of the same series that had *not* been in operation (curve A_2) withstood 6500 kg during the same number of load cycles, but failed later under a load of 7000 kg. To increase the resistance to fracture of the teeth the following mea-

(*Turn to page* 105, *please*)

* Excerpts from an article in the German periodical *Luftwissen*. Translation provided by the British Ministry of Aircraft Production. The tests and investigations referred to were conducted by the author in collaboration with officials of the Daimler-Benz Co. and the Fredrichschafen Gear Co.

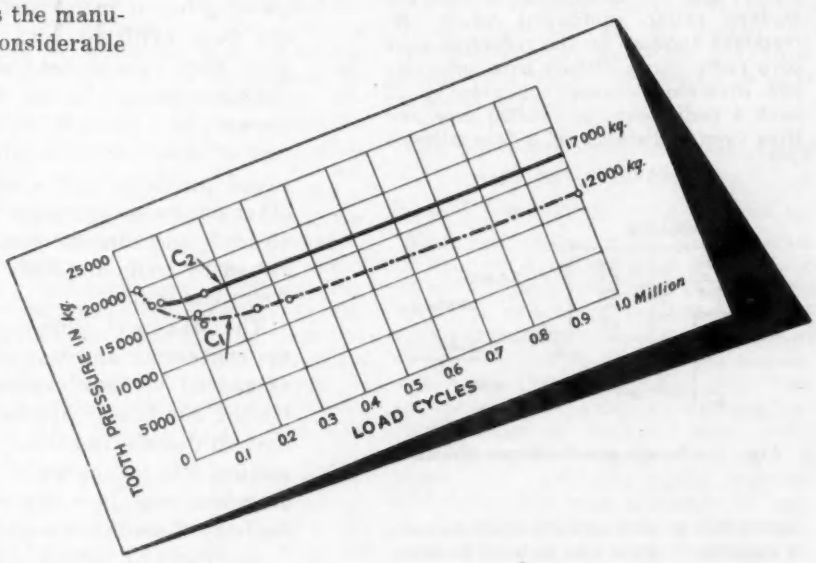

Fig. 3. (Above) Curves showing the influence of a polishing treatment of the tooth gullet. Curve C_1, teeth unpolished. Curve C_2, teeth of same gear after polishing.

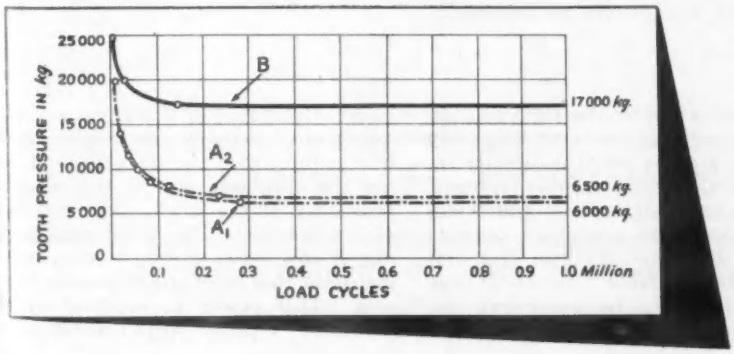

Fig. 2. (Left) Curves showing results of tests made with the apparatus shown in Fig. 1. Curves A_1 and A_2 relate to gear as originally finished (after use and before use respectively), and curve B to one of the same series of gears after special treatment.

Wartime Engineering Progress Highlights SAE

IMPORTANT wartime aviation developments and their possibilities for peacetime use were unfolded during the National Aeronautic Meeting sponsored by the Society of Automotive Engineers early in October at Los Angeles. In attendance at the three-day sessions were more than 2000 engineers, designers and company officials from the aircraft and allied industries. J. L. Atwood, executive vice president of North American Aviation, Inc., was general chairman of the meeting:

The aircraft Engineering Display, a regular activity in conjunction with this West Coast meeting, attracted hundreds of engineers who took the opportunity to view nearly 40 exhibits of aviation products and manufacturing processes. The committee which planned this display was headed by J. H. Kindelberger, president of North American Aviation, Inc.

In recognition of his contribution of basic engineering, methods and data for improving the fatigue strength of metal parts for engines, J. O. Almen, Detroit research engineer, was awarded the SAE Manly Memorial Medal at an impressive presentation presided over by A. T. Gregory, chief engineer of Ranger Aircraft Engines and a member of the Manly Memorial Committee. The Almen paper, which was given at the SAE War Materiel Meeting in June, 1943, at Detroit, disclosed that fatigue failures result only from tension, never from compressive stresses, and that some metal-treating methods, including surface finishing, may reduce the fatigue strength of engine parts by creating stresses and altering physical properties. It advocated shot blasting to put metal surfaces in a compressive state. Mr. Almen, who has been affiliated with the General Motors Research Laboratories since 1927, is now head of Mechanical Dept. No. 1 there.

Thirty papers in the field of design, production and operation of aircraft and aircraft engines were presented at 12 technical sessions, two of which were devoted to symposiums—one on the flight operational problems and characteristics of transport airplanes, and the other on the environment of the airplane, which comprised a discussion of high altitude, thermal, humidity and dynamic load effects as analyzed by four engineers from Boeing, Douglas, Lockheed and North American staffs.

The transport symposium was one of the outstanding sessions of the conference and was attended by a large number of engineers who assembled to hear experts from Transcontinental and Western Air, United Air Lines, American Airlines and the Pan American Airways System discuss important problems in transport operation. The symposium was in charge of William Littlewood, American Airlines vice president, who is is chairman of the SAE Air Transport Engineering Activity Committee organized about seven months ago.

Abstracts of papers dealing with the current engineering developments are presented herewith:

The Sonigage

By Wesley Erwin, Research Laboratories Div., General Motors Corp.

IN HIGHLY stressed parts of modern airplanes the complete inspection of section thickness after final machining is important. This inspection becomes a difficult problem on some finished parts where the inner surface of a wall is not accessible. In some cases an instrument requiring only external contact to the part is necessary. The Sonigage, which was developed particularly for the inspection of the hollow steel propeller blades made by Aeroproducts Division, is such a device. High frequency sound waves, i.e., supersonic vibrations, are used by this instrument to determine the material thickness.

The problem of measuring thickness by surface contact is somewhat similar to that of measuring the depth of the ocean; also the measurement with the modern radar equipment which determines distance by the reflection time of a radio wave. Short time intervals are involved because the velocity of such a radio wave is 186,000 mps and thus even a distance of a few miles is equivalent to only several microseconds. A supersonic wave can be used to measure the thickness of metal parts by the echo method. However, with thin sections the time intervals involved are extremely short, which is due to the high velocity of sound in metals, for example, about 250,000 ips in steel. Therefore, in a piece of steel ⅛ in. thick, the echo will return in about one microsecond. Complicated electronic circuits are involved in these measurements.

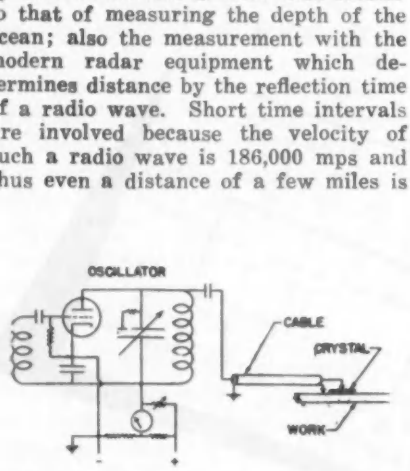

Fig. 1. Sonigage electrical circuit

The simplicity of the Sonigage is due to the fact that it does not measure the time intervals directly but rather the frequency at which the work is set into resonant vibration in the thickness direction. Since this resonant frequency in plates of a given metal is directly related to the thickness, the measurement of the frequency determines the thickness. Th Sonigage, therefore, consists only of an electronic oscillator of a simple one-tube variable frequency type and a quartz crystal for converting this electrical energy into mechanical vibrations. Operation of this instrument requires only pressing the quartz crystal into contact with the material and tuning the oscillator dial to the resonant frequency of the work. The circuit is shown in Fig. 1. Due to internal damping of the metal, power is required to maintain this resonant thickness vibration. This power is supplied by the oscillator. A power output meter serves

Aeronautic Meeting

By James R. Custer

to indicate the resonant frequency of the work in much the same way as the "Magic Eye" on a radio serves to indicate tuning to resonance with a particular station frequency.

With the Sonigage this resonance point is very sharp and if the oscillator is detuned as little as one per cent the indicated power amplitude is greatly reduced. As designed, the Sonigage measures the thickness of metal sections in the approximate range of .020 in. to .400 in. with a maximum error of less than two per cent. For measuring different metals, various calibrations or the use of conversion factors are necessary.

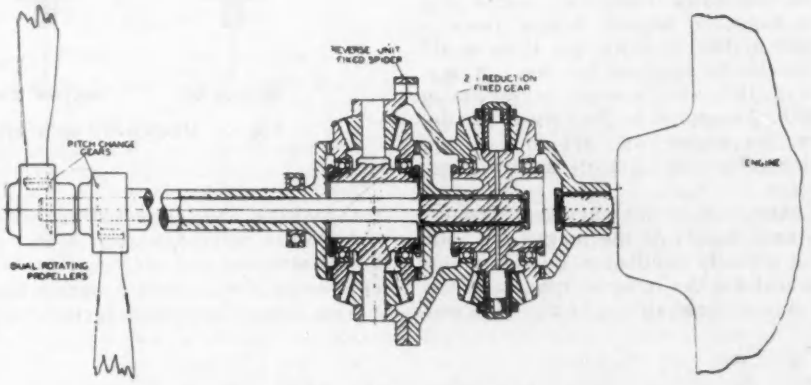

Fig. 2. Main drive-engine to propellers

Aircraft Bevel Gears

By L. J. O'Brien, Mechanical Engineer, Gleason Works

With the development and improvement in aircraft, the demand for bevel gears to meet many special requirements has increased considerably. In power-operated control drives for retractable landing gears, bomb bay doors, rudders, ailerons, gun turrets, and others, bevel gears in connection with hydraulic or electric motors have provided a logical system of supplying power to any location in the airplane. They maintain the proper relationship of all blades in variable-pitch propellers and provide a means of reversing shafts for dual-rotation propellers. This application is illustrated in Fig. 2, the arrangement combining, first a reduction, second the reverse unit, and third the variable pitch dual rotation propellers.

While strictly speaking it is not a bevel gear, the curvic spline is a recent development which is an outgrowth of curved-tooth bevel-gear cutting. These splines are used in fixed couplings, semi-universal couplings, overload clutches, and engaging-type clutches. These splines are cut and ground on standard bevel-gear cutting and grinding equipment using standard cutters and grinding wheels. The teeth are curved and the amount of tooth contact can be controlled. Pressure angles from 0 deg to 30 deg are used depending upon the application. The accuracy obtained in grinding these splines is such that alignment of parts may be maintained to very close tolerances. One of the large radial engines now in production has a built-up crankshaft with parts coupled by ground curvic splines. Recently a two-throw crankshaft for a small auxiliary engine was built up from completely interchangeable parts. The crankpins, crankcheek and main bearing members were hardened and individually finished to final size. Curvic face splines were then ground from the solid in each part as the final operation. In this application a new crankpin or center member could be inserted without removing the crankshaft from the engine.

The Zerol gear has been used extensively in aircraft to overcome some of the limitations of the straight bevel. It has the same thrust and tooth action as the straight bevel and may be used in the same mountings. However, all front and rear hub projections above the root line must be eliminated to provide cutter clearance in curved tooth gears. Spiral bevels properly designed will have at least two teeth in contact at all times and for this reason will transmit as much as 30 per cent more power than the corresponding straight or Zerol bevels.

The Development of Spar Caps with Integral Fittings

By J. F. Schirtzinger, Douglas Aircraft Co.

The spar caps under consideration here are for a new military airplane of conventional two-engined design, the wings of which are one-piece units of two-spar construction and are attached to the fuselage by a shear pin connection at the end of each spar cap. The spars are of the partially developed tension field type consisting of heavy, solid aluminum alloy cap members and a sheet web with hat-section vertical stiffeners. The spar system is of particular importance because the entire bending load in the wing is carried by the spars. The skin covering of the

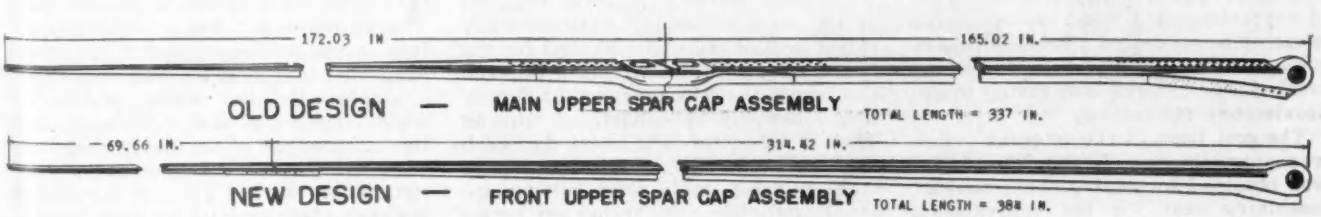
172.03 IN
165.02 IN.
OLD DESIGN — MAIN UPPER SPAR CAP ASSEMBLY TOTAL LENGTH = 337 IN.
69.66 IN.
314.42 IN.
NEW DESIGN — FRONT UPPER SPAR CAP ASSEMBLY TOTAL LENGTH = 384 IN.

Fig. 3. Spar caps of spliced (upper) and integral (lower) types

wing utilizes chordwise stiffeners and takes only drag and torsion loads.

Fig. 3 shows the previously designed spliced spar cap compared with the integral type which proved to be economically justified. A rapid picture of the structural and manufacturing cost may be obtained by examining the exploded sketches of Fig. 4.

For fabrication of the integral type spar cap the method adopted consisted of utilizing the material which normally would be lost in chips to fabricate a second spar cap. This was accomplished by designing a bar shape which, when split diagonally lengthwise, would give two tapering section billets from a length of bar little greater than would otherwise be required for one. A layout of this arrangement is shown in Fig. 5. Compared to the forged bar design, the saving was 170 lb per cap, which offset the difficult splitting operation.

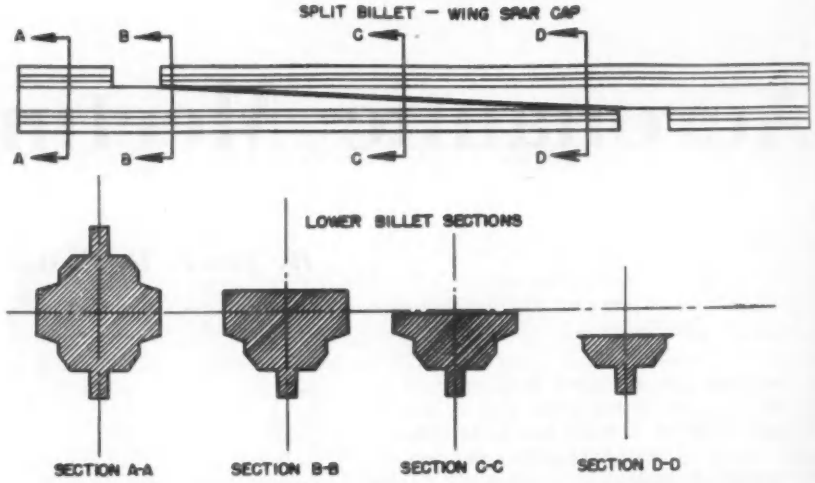

Fig. 5. Diagonally split billet for fabricating integral type spar cap

Contrary to preliminary expectations, the final design of the diagonally split billet actually resulted in a lower material cost for the integral type cap than for conventional spliced caps. This was due to the relatively high material utilization resulting from the tapered blank, and the lower cost per pound of the rolled 14S material, as compared with the 24S extrusion. The rolled billet was purchased for 30 cents a pound, compared with 46 cents a pound for extrusion, and 90 cents a pound for the forged end. At the time scrap 14S material was valued at 11 cents a pound and there was a material cost saving of approximately $30 per cap, compared to conventional design. Recent drops in salvage value of aluminum have decreased this material cost saving to approximately $15 per cap.

The cost limit of the integral design was approximately $330. This figure was obtained by adding the estimated machining cost for the conventional spliced design of $125, the weight and cost savings from eliminating splices which were approximately $175, and the $30 material cost saving. This $330 represented the extreme economic limit, and no actual monetary saving would occur until the fabrication cost of the integral cap dropped to less than $200. This latter figure was obtained by adding the $125 machining cost of the conventional design, the $30 material cost saving, and that portion of the $175 cost-weight saving that represented direct cost.

Existing spar cap milling machines were completely inadequate for the large scale material removal required by the integral design. Approximately 75 per cent of the material used for the spar caps had to be machined off, and this meant that the spar cap machinery would have to be capable of turning 3000 lb of metal into chips for each airplane produced. At the time, router type spar cap mills were cutting approximately two cubic inches per horsepower per minute, and it appeared that the success of the design would be largely dependent on the amount of power that could be applied to spar cap milling machines.

A picture of the extent to which power was a factor may be obtained from one estimate which indicated that 4800 machines, 9000 skilled machinists, and a total machine investment of $31,000,000 would be required to produce the required quantity of caps on standard horizontal and vertical milling machines. These somewhat alarming figures also indicate the extent to which the integral design depended on tooling ingenuity and recent changes in the art of machining light metals.

The special machines finally selected for the job were conceived by Douglas tooling engineers in cooperation with the Farnham Manufacturing Co. and the Ingersoll Milling Machine Co. The typical special mill being used on these caps is made up of a major tool carriage carrying either four or six horizontal cutting heads, each powered by a 40 hp motor. The six-head machine, with a total of 240 hp, is capable of reducing an eight-foot 2 by 4 of 14ST bar into chips in one minute.

In monetary terms, it is expected that in the projected quantities, the integral fitting design will result in a final cost saving of $6,500,000, including a weight value of $5,500,000.

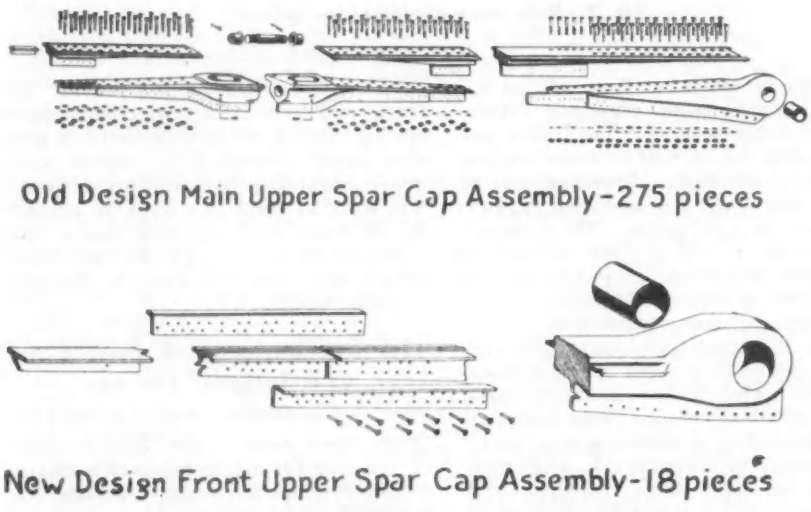

Fig. 4. Exploded views of spar cap assemblies

Research and Tomorrow's Aircraft Undercarriage

By Roy W. Brown, In charge of Aviation Products Research, The Firestone Tire & Rubber Co.

To date several large planes have used dual or tandem wheel mountings in the undercarriage. It has been suggested that dual wheels mounted on a single axle, the center portion of which engages a dual disk brake and the outer edges of the brake disks engaging a fluted circular member constructed as the end piece of the alighting gear offers promise for light weight, simplicity and low cost. This dual ar-

rangement permits spacing the wheels as close together as would be the case with wheel brakes. This point is important when considering one wheel and side drift landings. Such a dual wheel arrangement appears quite promising for an airplane of 120,000 lb gross weight, and possibly larger planes up to 300,000 lb.

A suggested multiple arrangement, combining the function of the main and the auxiliary gear, consists of a number of interchangeable eight-wheel articulated undercarriage units, each of which is aligned fore and aft and laterally along the under side of the fuselage with similar units on the opposite side. Each set of four wheels on an eight-wheel unit is attached to an arm which is pivoted at the center to either side of the absorption element of the alighting gear. Swivel action can be included when desired.

This visionary thinking, of course, is subject to many detail limitations, but it is believed that the trend unquestionably will be in that direction if land planes of very large size are to compete with sea planes. A large German transport plane has its undercarriage wheel units arranged in rows of five at the lower outer edges of the fuselage. It is reported that many of these aircraft were operated into and out of fields without any surface preparation.

NEW MATERIALS AND PROCESSES—A need has existed for a flexible permanently lubricated material suitable for guide bushings to position alighting gear parts where only occasional motion is required. Such a material has been developed. It consists of vulcanizing specially prepared fabric to rubber and impregnating the fabric after vulcanization with thixotropic wax. This new material is well adapted to use on polished, unmachined surfaces.

Another new technique produces weld in heat-treated steels having physical properties approximating those of the parent heat-treated metal. Briefly, the process consists of depositing welding metal of equivalent chemistry to that of the parent metal. "Preheat" and "After Cooling" are provided in a precision manner by carrying out the welding within a controlled temperature furnace. The new technique enables the fabrication of heat-treated steel brackets for the attachment of the undercarriage to the ship structure. They are much stronger and much lighter than the lightest non-ferrous metal castings.

Most extensive knowledge of the use of rubber in compression and improved precision rubber molding techniques and processes for adhesion to heat-treated steels has enabled manufacture of air springs and rubber springs. It is believed that the new technique will enable more extensive logical use of rubber in aircraft, particularly as elastic load carrying structures.

UNDERCARRIAGE DESIGN—Study of the multiplicity of types and

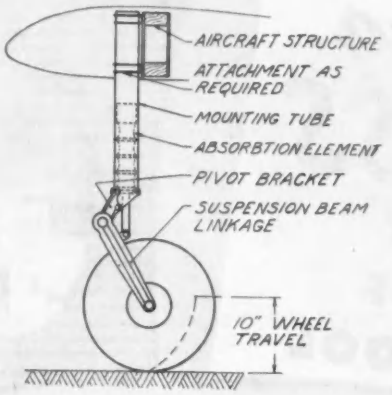

Fig. 6. Optimum undercarriage indicated for planes under 3000 lb.

characteristics of undercarriages developed to date indicate a most promising new combination of design detail is now possible. A sketch of the proposed design of undercarriage suitable for planes weighing from 1000 to 3000 lb is shown in Fig. 6. It will be noted that a vertical tube is used to carry at its upper end the desired attachment fitting. The absorbing unit fits into the lower end of this tube. A bracket also attached to the lower end of the tube extends laterally and serves as a pivot for a fabricated suspension beam linkage to which the wheel and brake is fitted at the opposite end. The absorption member is pivoted to the suspension beam about a quarter of the way between the wheel center and the pivot at the opposite end. This type of construction for torque arms is very advantageous for tail gear and nose gear usage.

New Aspects of Airline Aircraft Maintenance

By Reagan C. Stunkel, General Service Manager, Lockheed Aircraft Corp.

AN AIRPLANE should be designed to be maintained. Service considerations must enter the design compromise in the preliminary stages and must occupy the same degree of importance as that accorded to aerodynamics, structures, weight and all of the other engineering considerations comprising the development of an airplane.

A maintenance specification must be drawn to form an objective of accomplishment for detail engineering design. This specification should be the considered result of a study of existing trouble frequencies, time-consuming operations, and operating data of aircraft presently in operation. During the mock-up stages, items of equipment accessibility, interchangeability, inspection time, and time for replacement may be carefully investigated and corrected before a large number of engineering hours have been expended.

To illustrate more graphically one method of mock-up investigation for serviceability in the early stages of design, the objective in this particular aircraft was to secure at least 18 hours per day of utilization, allowing a maximum of 6 hours per day for all overhaul and maintenance procedures. It followed, therefore, that each item of maintenance requiring more than 6 hours of accomplishment would require modification to reduce the maintenance time below the 6-hour limit. The entire aircraft mock-up was investigated in detail and an example of one is shown in Fig. 7. The investigation imme-

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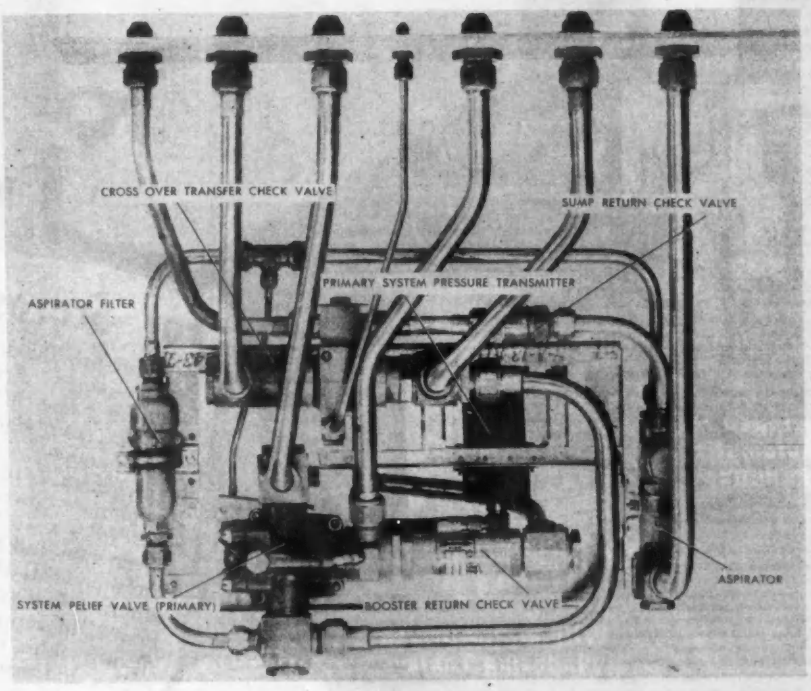
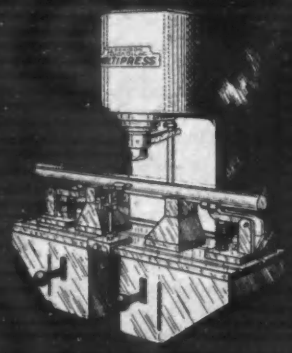


Fig. 7. Primary system

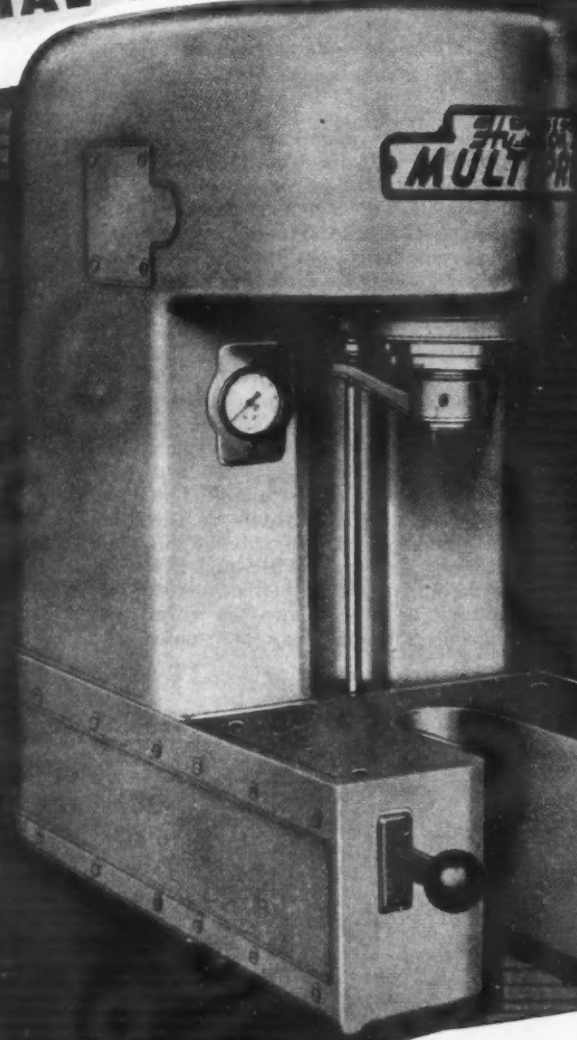
Announcing MULTIPRESS

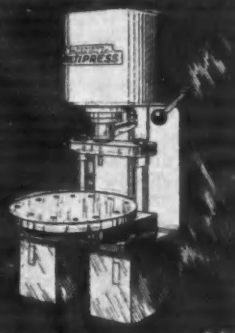
AN ENTIRELY NEW KIND OF INDUSTRIAL TOOL



With Straightening Fixtures

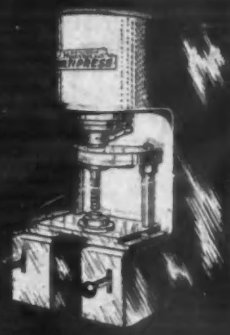
With Honing Fixtures

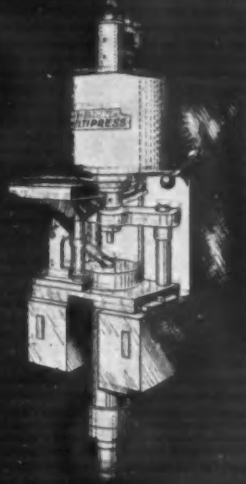




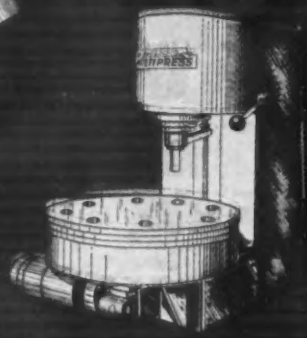
Showing Dial-Type Feed

With Branching Attachment





Equipped for Automatic Pelleting



With Motor Driven Indexing Table

For Scores of Production Jobs

A 4-ton production giant in midget form . . . a completely self-contained, bench-size, oil-hydraulic machine tool of amazing scope. MULTIPRESS delivers downward ram pressures of from 300 to 8,000 pounds . . . upward pressures to 5,000 pounds . . . in strokes which may be regulated from 6 inches to 1/16-inch . . . at ram speeds up to 200 inches per minute downward, and 300 upward! Its work-table measures $10\frac{1}{2}$ x 16 inches without extensions. The opening between ram and table is 11 inches. In addition, there are fixtures and attachments for MULTIPRESS which fit it for almost every type of operation requiring pressure . . . sustained, in repeat strokes, synchronized with indexing tables, in single or automatically repeated cycles, and many other ways! Write today for details on this new HydrOILic tool of multiple uses!

Basic Unit **$575.00** f.o.b. Col's.

The Denison Engineering Company

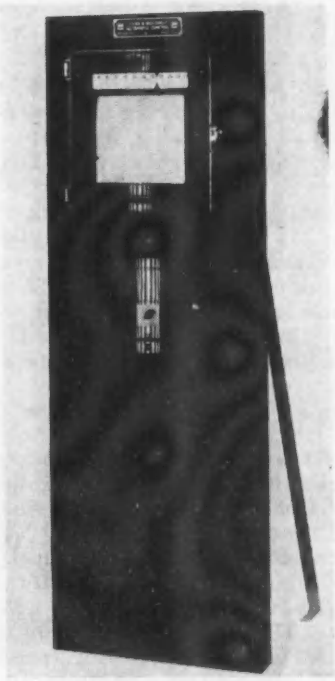
1178 Dublin Road, Columbus 16, Ohio

DENISON EQUIPMENT for APPLIED HydrOILics

HydrOILics INDUSTRY'S RIGHT HAND

New Production Equipment

LEEDS & NORTHRUP CO., Philadelphia, Pa., has brought out a new Micromax electric control for the regulation of temperature of electrically-heated furnaces, ovens and similar units. Called "Micromax electric control, duration-adjusting type," this system not only regulates electric input to hold temperature at a selected control point or to a program, but is said to hold it there so dependably that users obtain the most efficient balance among product uniformity, speed of output, flexibilty of operation.



Micromax electric control

By means of an "on-off" contacting system, it feeds to the heating unit the electric current needed to keep temperature to the required control point or program. Input is either "full-on" or "full-off." Regulation is obtained by controlling automatically the time during which current is "on" and "off." The new system provides automatic droop-correction. It can be equipped with overshoot control, valuable when the furnace or other unit is coming up to temperature.

X-RAY pictures can be taken through pieces of steel a foot thick, using a new 2,000,000-volt mobile X-ray unit made by the General Electric Company, Schenectady, N. Y.

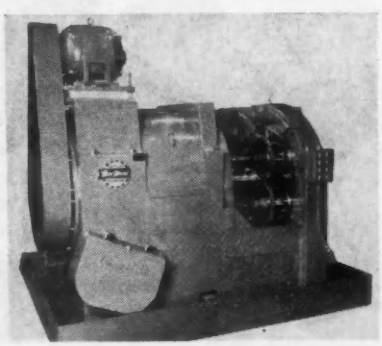
This doubles the voltage of X-rays available to industry for examination of metal sections to find defects. Up to now the most powerful X-ray unit in general use has been the million-volt apparatus developed in the G-E laboratory.

In radiographing an 8-in. steel casting the two million-volt outfit is 78 times as fast as the million-volt. Under one typical set of conditions, 4½ hr were required to make an exposure through this thickness with a million volts. Two million volts did it in 3½ min. For still thicker sections the ratio is even greater. Two million-volt X-rays are said to make a satisfactory exposure through a foot of steel in about two hours when the Type A X-ray film is used at a distance of 3 ft from the end of the tube. For practical purposes such a thickness is opaque to million-volt X-rays.

DAVIS AND THOMPSON COMPANY, Milwaukee, Wis., has developed a single end horizontal rotary continuous boring machine, the Model 1H, with six stations for the boring and facing of 155 mm shells. A special feature of this machine is the automatically operated collet chucks which insure concentricity of the holes to the outside diameter.

The shells are manually loaded from a conveyor. Locating for length is automatic from boat tail end by a spring cam and a positive stop. The chucks holding the parts are automatically closed, and by means of a clutch mechanism, rotation of chucks is started.

When the cycle of the machine is started the spindle carrying the roughing, finishing and facing tools is fed by means of a cam to the correct depth. Operations are completed after three-quarters of a revolution of the machine is made. At the pre-determined point where the hole is completed and the tool is withdrawn, the rotation of the machine is stopped, the clutch opened and the shell ejected onto a conveyor. All operations are automatic.



Davis and Thompson boring machine

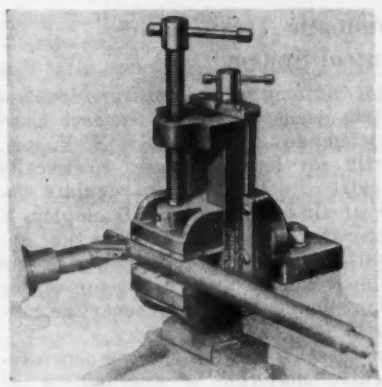
A ¼-IN. impact wrench is now added to the line of Aro pneumatic impact tools made by The Aro Equipment Corp., Bryan, Ohio.

Operating with controlled torque, this tool is designed to completely eliminate stretching or "burning" of threads in setting nuts, bolts or Phillips screws. It is capable of both forward and reverse rotation and has a calibrated adjusting screw on the side of the motor that enables the operator to set any bolt, nut or screw to any desired tension.

The Model 106 is particularly desirable for use in driving Phillips, Reed and Prince, or Allen head screws. The action of the impact mechanism is such that while it drives the screws to the desired tightness, it will not tear the head of the screws or break the bits.

Model 106 impact wrench

Capacity of the tool is up to ¼-in. bolt size; overall length, 7⅛ in.; spindle offset, 1 1/32 in.; square drive, ⅜ in.; weight, 2⅞ lb. It comes complete with one socket and an 8-ft length of 5/16-in. hose with fittings.



No. 250 Palmgren milling attachment

CHICAGO TOOL & ENGINEERING CO., Chicago, Ill., offers a milling attachment which can be mounted on the compound rest of standard engine lathes such as South Bend, Dalton, Atlas and others of similar size and type. It is called the No. 250 Palmgren milling attachment. A graduated screw provides vertical adjustments, and the base on which the vise rotates is gradu-

(*Turn to page 74, please*)

New Products for Aircraft

Hydraulic Connection Eliminates Tube Flaring

A new type hydraulic tube connection which eliminates the tube flaring operation has been developed by The Glenn L. Martin Company, Baltimore, Md. While designed to meet specific needs of the aircraft industry, the new fitting, which can be used with both low and high pressures, is said to be equally adaptable to the requirements of other types of hydraulics.

Basic parts consist of the fitting, a gland nut, a small metal collar and a synthetic rubber sealing ring. The fitting is bored in four concentric diameters, corresponding respectively from the center out to the ID of the tube, the OD of the tube, the OD of the rubber ring and metal collar and the OD of the gland nut, with the outside section threaded to take the gland nut.

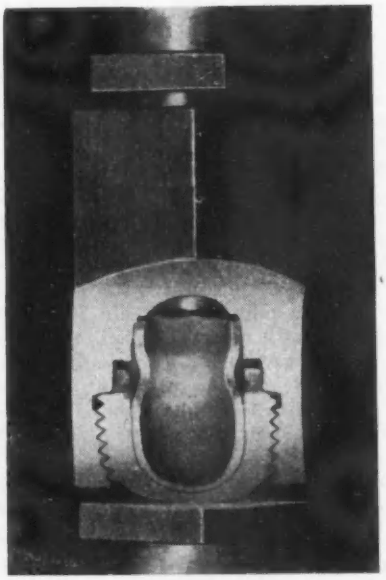
To install the new fitting, one places the gland nut, metal collar and rubber ring over the end of the tube in that order and inserts the tube in the gland as far as it will go. By turning up the gland nut, force is exerted on the rubber ring with the metal serving to keep the nut from tearing the ring. Since the sealing ring is completely confined, and rubber is not compressible, the axial thrust so developed grips the tube and actually beads it. At the same time, the rubber is forced into every crevice to form a seal and exerts an outward force on the gland nut, locking the threads.

Automatic Temperature Control System

An automatic temperature control system designed by the General Electric Company, Schenectady, N. Y., primarily for fighter planes, electrically operates the flaps which regulate the flow of air to the engine. It employs a temperature-sensitive material that automatically controls the cooling of the engine head, oil and carburetor air or coolant temperature, whichever the case may be.

In the G-E system the temperature-sensitive material, a combination of metallic oxides, starts opening the flaps at some predetermined temperature. When the highest allowable operating temperature is reached, the flaps will be full open. Using a relay of only eight-ten-thousandths of a watt in power, the modulating control can stop the flaps at any position between open and closed, the position depending on the temperature of the engine.

This automatic control system is now being readied for installation on late-model military planes and adaptable to large commercial planes of tomorrow.



Martin hydraulic fitting

New Branch Opened by General Controls Co.

General Controls Company of Glendale, Cal., has opened a branch at Kansas City, Mo., with Robert Courtney in charge as branch manager. The new quarters provide complete facilities for serving customers in Kansas, and in adjacent areas in Missouri, Nebraska and Iowa.

Too Busy to Celebrate

The Wright Aeronautical Corporation was twenty-five years old last month but the urgency of war production precluded any formal observance of the occasion. The Corporation expects to celebrate its silver anniversary after the cessation of hostilities.

Fairchild Introduces New Aircraft Engine

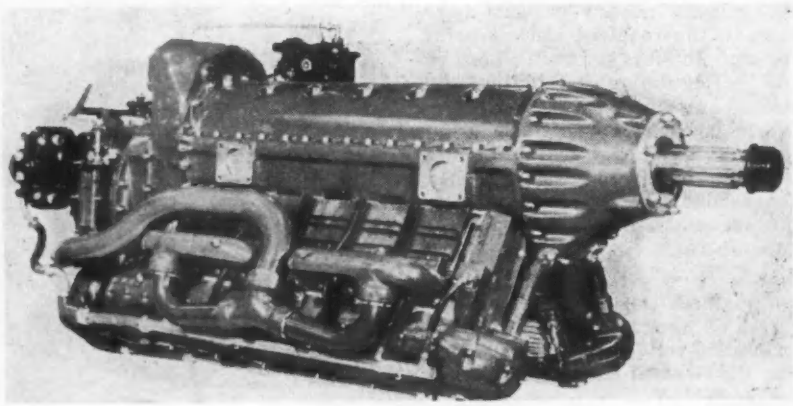
Development of a new compact, lightweight aircraft engine is announced by the Fairchild Engine and Airplane Corporation, Farmingdale, Long Island, N. Y. Weighing but 870 lb, complete with standard accessories, the engine develops 700 hp, nearly 1 hp for each cu in. of displacement. It is an air-cooled, 12-cyl, V-type, and like other Ranger designs it is inverted, having its cylinders extending below the crankshaft.

The engine has an overall height of 31.11 in. It is 74.92 in. long and 33.28 in. wide. Cooling is accomplished by the pressure of air entering a scoop and directed around the cylinders by an arrangement of baffles which create turbulence in the air flowing around the cylinders. Cooling characteristics are enhanced by aluminum cooling fins chemically bonded to the steel cylinder barrels by use of the A1-Fin process.

Power sections are made of aluminum alloy. The six-throw crankshaft is dynamically balanced and connecting rods are of the fork and blade type. Overhead camshafts actuate the valve mechanisms on each bank of cylinders. Ignition is by high tension dual magnetos. The fuel induction system is designed around a new, advanced type of pressure carburetor.

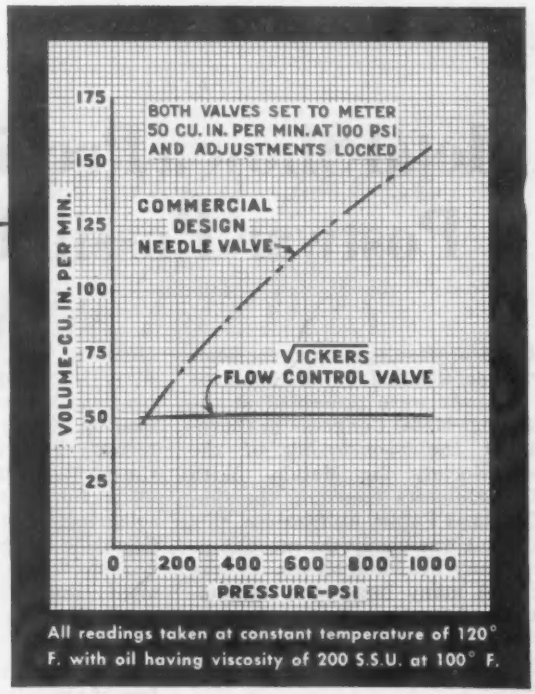
Pressure lubrication is of the dry sump type. Oil is transferred through drilled passages. The hollow accessory driveshaft is the main oil gallery. Splash and spray lubricates the cylinder wells, pistons and piston pins. Valve mechanisms are pressure lubricated.

The engine will be available with two propeller reduction gear ratios; 1.65 to 1 and 2.37 to 1. Planetary reduction gears are employed. At 3600 rpm for take-off, the propeller shaft speed is reduced to 2180 rpm by the first ratio and 1520 rpm by the second.



Ranger aircraft engine

CONSTANT FLOW RATE REGARDLESS OF VARIATIONS IN FLUID PRESSURE



All readings taken at constant temperature of 120° F. with oil having viscosity of 200 S.S.U. at 100° F.

VICKERS
FLOW CONTROL AND OVERLOAD RELIEF VALVES

In hydraulic control systems, this valve combines the functions of a flow control valve with an automatic relief valve to save space and simplify installation. It maintains a constant "metering-in" flow rate (for a given setting of the control adjustment) regardless of any variation in imposed fluid pressure resulting from changes in work resistance. Pump operates only at pressure required to do the work at hand; relief valve is independently adjustable and limits the maximum system pressure to any desired value.

This valve combines in one unit the means for accomplishing three independent functions: (1) adjustable control of flow rate in the hydraulic circuit, (2) adjustable overload pressure protection in the hydraulic system, and (3) remote "Start and Stop" control when used with suitable pilot valve. See Bulletin 40-22 for complete information. Vickers Application Engineers will gladly discuss with you how "hydraulics" can be used to your advantage.

VICKERS *Incorporated*

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Application Engineering Offices: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function

Metal Show a Preview of Postwar Possibilities

FRUITS of developments over some years accelerated by the demands of the war were presented at the 26th National Metal Congress in Cleveland under the sponsorship of the American Society for Metals. With some 375 exhibitors crowding the spacious Cleveland Public Auditorium, this year's exhibit was easily the most spectacular of any held heretofore. It was evident that many important developments ushered into use during the war were ready for post-war application upon receiving the green light from the government.

The offerings of exhibitors were designed to satisfy the immediate interest of thousands of metallurgists, chemists, research workers in the field of metals and metal treating processes, those interested in quality control, as well as those of production men interested in small tools, machinery, materials handling, and processes. Materials, products, and services ran the gamut of technical and scientific interest in so broad a sweep as to make it quite difficult if not impossible to do justice in a review article. Accordingly, it has been necessary to screen the exhibits and cover at this time only a selected high-spotting of what was actually on view. In short, there is no substitute for hours of leg work.

To further simplify the problem of high-spotting even a sampling of the exhibits, we have divided the presentation into a number of generalized groups as outlined under topical heading below.

Induction Heating—Electronics—One of the amazing phenomena of war production has been the expanding use of induction heating for speeding the selective heat treatment of metal parts, for hardening parts, heating for forging and upsetting operations, and low temperature quick cycle heating of parts for soldering and brazing. In the widening circle of manufacturers producing special equipment for these purposes are the following: General Electric Co., with a new 50 KW electronic heater for induction heating, heat treating, brazing; Westinghouse Electric & Mfg. Co., high-frequency induction heating equipment for metals and dielectric heating equipment for non-conducting materials; Budd Induction Heating, Inc., equipment for the heat treatment of internal diameters; The Ohio Crankshaft Co., well known for its TOCCO process of induction heat treating and heating also demonstrated new high-frequency equipment; Induction Heating Div., American Type Founders, Inc., induction heating unit for brazing, hardening, soldering, and annealing of ferrous and non-ferrous materials; Federal Telephone and Radio Corp., MegaTherm electronic induction units for surface hardening, brazing, soldering, and annealing of metals; Scientific Electric Div., Corrugated Gap Co., electronic induction heating equipment; Induction Heating Corp., Thermonic electronic high frequency induction system.

Quality Control—In this group are a few of the scientific production and laboratory methods for the non-destructive testing of materials and parts and for the exploration of surface finishes. Physicists Research Co. showed its latest applications of the well-known Profilometer for measuring surface finish; The Brush Development Co., with an exhibit of crystal products and the Brush Surface Analyzer for measuring surface finish; Sperry Products, Inc., showed the Sperry Electric Flaw Detector for inspection of tubing and bar stock, and the new supersonic Sperrytron for the exploration of the interior of solids for defects and discontinuities; Magnaflux Corp. had on view its famous Magnaflux inspection system, featuring a new conveyorized machine for continuous inspection of small parts, as well as the Zyglo fluorescent penetrant inspection of magnetic and non-magnetic materials; Magnetic Analysis Corp., production inspection by magnetic analysis of bars and tubes.

Plating, Cleaning, Finishing, and Allied Processes—E. F. Houghton & Co. introduced a mechanized production process for producing the Houghto-Black finish; and a new strip coating for export shipping and protection of parts; The Udylite Corp. exhibited a new fully automatic plating machine which is available as a compact package ready for installation and use; The Dow Chemical Co. with its Stripcoat packaging material; du Pont's electroplating division introduced the Halogen-Tin process for continuous and rapid electrodeposition of tin on strip and wire; Van Der Horst Corp. of America showed examples of Porous-Krome applied to diesel engine cylinder sleeves and cylinders as well as applications on aircraft engine cylinder barrels; Standard Steel Spring Co.. with new examples of Corronizing laying particular stress on the coating of mufflers and tanks; Alvey-Ferguson Co., high speed washing machines; Nox-Rust Corp., rust preventive materials; Rheem Research Products, Inc., Iridite solution treatment for protecting against corrosion of parts which are coated; Kolene Corp., unique metal cleaning process in preparation for bonding of bearing materials.

Heat Treating and Cold Treating Equipment and Materials—E. F. Houghton & Co., Cosmoline fingerprint neutralizer, quenching and heat treating materials of wide variety; Lindberg Engineering Co., heat treating equipment; Leeds & Northrup, heat treating equipment and instruments; Electric Furnace Co., heat treating equipment; Surface Combustion heat treating furnaces; Deepfreeze Div., Motor Products Corp., industrial sub-zero chilling equipment; Kold-Hold Mfg. Co., industrial sub-zero machines; Lakeside Improvement Co., flame hardening, aerocasing, Champanizing, and heat treatment; Fostoria Industrial Service, infra-red equipment for heating, baking, and drying; Ajax Electrothermic Corp., heat treating equipment.

Shot Peening—This is another new art for the development of fatigue resistance by surface conditioning. The art was given impetus by the research work of J. O. Almen, General Motors Research, which received wide publicity during the past two years. Equipment for shot peening and shot blasting is produced by the American Foundry Equipment Co. and the Pangborn Corp.

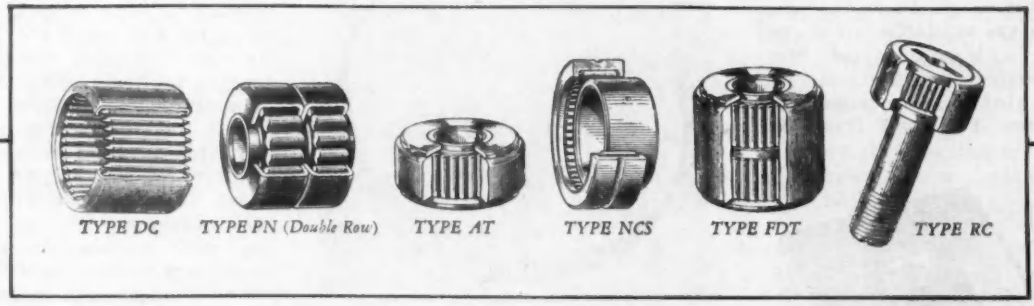
Instruments and Gaging Equipment—Among the manufacturers exhibiting such items were: Riehle Testing Machines Div., American Machine & Metals, Inc., showing the line of testing machines and instruments; Baldwin-Southwark Div., The Baldwin Locomotive Works, with a line of testing machines; Bristol Co., instruments—dilatometers, pyrometers, etc.; N. A. Woodworth, gages and instruments; W. C. Dillon, dynamometer for tension testing.

Cutting Fluids—The vital role of cutting fluids has been amply demonstrated during the war when the pressure was on productivity and quality. The proper selection of these materials must be given serious consideration in post-war metal removal planning. Among the major suppliers represented at the Congress were—The Texas Co., Cities Service Co., D. A. Stuart Oil Co., Ltd. E. F. Houghton made announcement of a novel all-purpose cutting fluid base which is miscible in either oil or water and can be diluted in varying proportions for specific applications.

Machinery and Tools—A sampling of this group is as follows: Cleveland Pneumatic Tool Co., riveters, chippers, pneumatic hammers, Cle-Air and Cle-Gruss shock absorbers; Andrew C. Campbell Div., American Chain & Cable, Inc., well-known Cutmatic abrasive cutting machines; Nelson Specialty Welding Equipment Corp., introducing the Nelson electric stud welder; The Aro Equipment Corp., with a line of

(*Turn to page* 108, *please*)

How Needle Bearings Meet Modern Design Trends



DEMANDS FOR HIGHER SPEEDS, LIGHTER WEIGHT, SIMPLER DESIGN, LONGER BEARING LIFE ALL MET BY ANTI-FRICTION TORRINGTON NEEDLE BEARINGS

•

The advantages of Torrington Needle Bearings in contributing to increased performance and operating efficiency of wartime equipment and materiel have demonstrated the opportunities they offer for design improvement in many peacetime products.

Speeds over 50,000 r.p.m.

One direction where Needle Bearings are being utilized with excellent results is in higher speed applications. Needle Bearings have operated experimentally at speeds as high as 60,000 r.p.m.In one aircraft application the regular DC Type Needle Bearing is operating at a speed of 20,000 r.p.m. In another rotating application utilizing seven DC Needle Bearings, operating speeds range from 7,000 to 14,000 r.p.m. under moderate to heavy load conditions.

Aid in Trend to Lighter Weight

Designs requiring weight reduction are frequently made possible through the use of Needle Bearings. The lighter weight of Needle Bearings themselves and the simplification of designs made possible by their compact size and high capacity both contribute to weight-saving designs.

And Longer Bearing Life

How Needle Bearings are contributing to increased efficiency and longer life is well illustrated in an application of two precision DC Type to the wrist pin end of the connecting rod in a portable gasoline engine. Designed for long periods of operation without servicing, it was found that anti-friction Needle Bearings doubled the service life. The basic design of all Needle Bearings aids in providing efficient lubrication, which is an important contributing factor in service life and in freedom from maintenance and repair.

Our engineering department will be glad to work with you in utilizing to the full all the advantages of Needle Bearings to your own design requirements and in recommending the type and size for any specific application. If you do not already have the Torrington Needle Bearing Catalog in your engineering files, send for your copy. It contains a wealth of data on these modern anti-friction bearings for modern design needs.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend 21, Ind.

"Makers of Needle Bearings and Needle Bearing Rollers"

New York	Boston	Philadelphia
Detroit	Cleveland	Seattle
San Francisco	Chicago	Los Angeles
Toronto		London, England

LET'S GO! U.S.A. KEEP 'EM FLYING

TORRINGTON

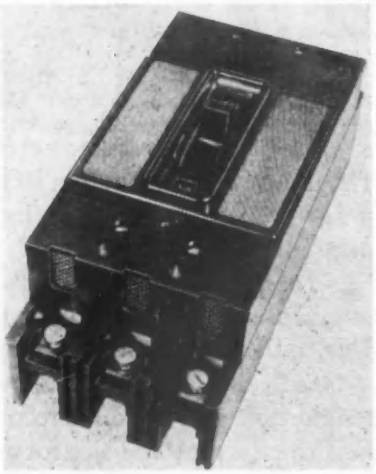
NEEDLE BEARINGS

New Products

Compact Circuit Breaker

A 100-amp "De-ion" circuit breaker which requires less space and permits lighter structures for distribution panelboards, built-in applications and bus duct plug-ins is announced by Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

All ratings are available in one compact breaker with uniform pole spacings and terminal arrangement, providing complete interchangeability between ratings. The new F frame permits for the first time a 100-amp, 600-volt a-c or 250-volt d-c breaker in the same space formerly required by the 50-amp, 600-volt a-c or 250-volt d-c rating.

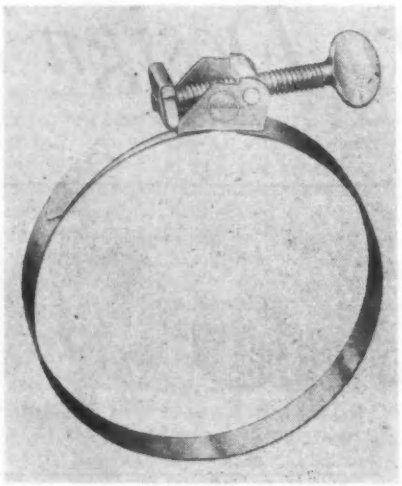


Westinghouse 100-ampere circuit breaker

Equipped with thermal and instantaneous magnetic trip elements, the "De-ion" fuseless circuit breaker permits maximum loading of circuits and fast resumption of interrupted service. Contact pressure increases with wear, thereby prolonging the life of contacts and breaker. Silver alloy contacts give increased contact life with lower wattage loss. The special alloys used also prevents "freezing." Both two and three-pole units are available.

Hose Clamp Has Swivel Action Nut

The Universal series 820 stainless steel flexible-band hose clamp offered by Marman Products Co., Inc., Inglewood, Cal., is said to be especially suitable for the automotive field. At the Naval Aircraft Factory, this clamp met all requirements of AN-FF-C-406a hose clamp specification, which included these tests: accelerated salt water corrosion, maximum load, average deflection, wrench torque, leakage pressure and reuse.



Marman Universal Series 820 hose clamp

Special construction features include a swivel-action nut that rocks on swivel pins and tips down when the thumb screw is tightened. This cinches band under all conditions of torque adjustment and pressure, and prevents slipping. The flexible band conforms to the shape of any clamping surface and has no tendency to pinch, regardless of screw pressure. The clamp is vibration-proof and remains tight under all conditions. Rugged construction permits reuse without efficiency loss.

"Photo-Arc," a New Type of Photographic Paper

A new type of photographic paper which is said to possess great latitude and remarkable tolerance to ordinary artificial light has recently been introduced by Peerless Photo Products, Inc., New York, N. Y., for use on commercial blueprint machines.

Peerless "Photo-Arc" papers are described as opening up to the blueprinter the field of photo-reproduction, for which cameras and contact box printers have hitherto been necessary. Now, without the installation of a darkroom or special printing equipment, the blueprint operator can make black and white photographic reproductions on either paper or transparentized vellum. He can copy blue prints, old yellowed drawings or weak pencil tracings. High-contrast, litho-type paper negatives can also be made, even from pencil drawings. Such negatives are particularly useful for positive reproductions on cloth.

No darkroom is needed for "Photo-Arc" papers. They can be handled and processed without dimming the usual lights in the room. Photo-Arc papers are also reported to be an excellent medium for copying letters or documents as they produce an exceptionally fine reflex-type negative, essential when the original manuscript is printed on both sides.

Face Protection Shield Designed for Comfort

An improved type of face protection shield, designed for maximum comfort, has been brought out by Willson Products, Inc., Reading, Pa., for light duty operations such as spot welding, light grinding and wood-working. Made to fit over correction spectacles and extending well back along the sides of the face, the shield provides complete protection for face and forehead.

Extremely light in weight, the new Protecto-Shield (Type V-1) offers these features: adjustable headband which assures perfect fit, front cushioning with replaceable leather sweatband, back cushioning with pliable plastic tube, tough light-weight brow guard which protects the forehead, and combination friction swivel and guard which permits easy raising of the shield but prevents blows from pressing it against the face. This shield may be obtained with either clear or green visor in 4-in., 6-in. or 8-in. visor lengths.

Willson Protecto-Shield

Westinghouse Cathode Ray Oscillograph

A stream of electrons, driven in a pencil-thin beam, are photgraphing electrical sparks that flash in front of them at more than 5000 miles an hour, it was reported recently. Stopping the speeding spark flashes at one-tenth of a millionth of a second, the electronic beam is recording airplane engine ignition actions to help solve the problems encountered in producing warplane motors, according to the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

The electronic device which guides the electrons in their new task is the streamlined Westinghouse cathode ray osillograph which takes pictures on the household variety of camera film and makes its impressions in much the same manner as an X-ray.

(*Turn to page* 102, *please*)

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

A recent survey shows that 89% of the tire and rubber companies and 86% of the paper companies will have new products to offer after the war. 58% of all manufacturers questioned have something entirely new for post-war customers.

get ready with CONE for tomorrow

A new heat-treated glass is in production that resists thermal shock and temperatures to 650° F.

get ready with CONE for tomorrow

One of the large tire manufacturers has just patented a tubeless, uninflated automobile tire.

get ready with CONE for tomorrow

Bimetallic cylinders for internal combustion engines, in which a copper sleeve is bonded to a cast iron cylinder, promise to lessen greatly the problem of heat transfer that has always interfered with high performance.

get ready with CONE for tomorrow

Indium, once worth $20,000 an ounce, now costs $7.50.

get ready with CONE for tomorrow

A plant has just been opened to rebuild completely automobiles by the production line method to new car standards.

get ready with CONE for tomorrow

Aircraft engineers imagine that the big airlines of the future will dispense with landing gear entirely and will be electronically guided into a wheeled cradle at each landing field.

get ready with CONE for tomorrow

The same type of mechanism now used to stabilize the guns of moving tanks could be used to provide smoother riding trains.

get ready with CONE for tomorrow

Foam rubber is expected to replace familiar upholstery construction in automobile seats, saving nearly a foot in the length of the body.

get ready with CONE for tomorrow

One big national picture magazine plans to print entirely in full color after the war.

Factory roofs actually supported solely by air blast from ventilating fans are in use and are the subject of serious experiment.

get ready with CONE for tomorrow

Snap-on molded rubber covers are now being used to mask those parts of electro-plated objects which must remain bare.

get ready with CONE for tomorrow

San Francisco has a plan for a 25 million dollar "World Trade Center" covering twelve blocks of its water front and including a free trade zone.

get ready with CONE for tomorrow

Glass jewels, for instrument bearings, can now be turned out automatically at the rate of 3,500 per day. They are preferable in some respects to natural sapphires.

Through careful research and improvement, one familiar office machine has had 94 per cent of its noise eliminated or absorbed.

get ready with CONE for tomorrow

Electrically conductive rubber is being used to heat aircraft guns and propellers.

get ready with CONE for tomorrow

By the use of a resin extracted from Southern pine, foundries have been able to reclaim old sand and reduce their consumption of new sand as much as 75 per cent.

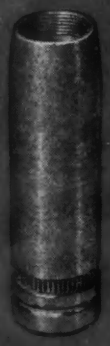
get ready with CONE for tomorrow

A new filtering material, made of pure rubber latex, has as many as 6,400 holes to the square inch.

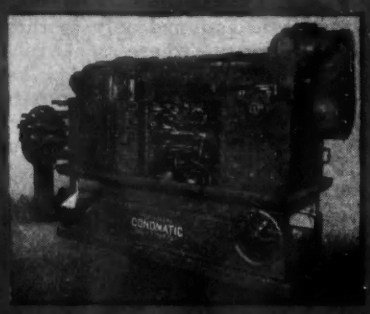
get ready with CONE for tomorrow

A new adhesive bonds wood to metal, making possible a new product consisting of a 1/48″ ply of wood combined with a thin layer of sheet steel. This material can be readily cut and bent, and is decorative, durable, and fireproof.

Automatic Production at automatic-cannon speed



The 1⅝″ 8-Spindle Conomatic produces these 20mm. tracer bullets in 8 seconds each. Production like this keeps shell supplies ahead of the requirements of rapid firing guns. Conomatics, in wartime, are a military necessity — in peacetime, an economic necessity.



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

Demands for Immediate Reconversion Die Down with Changing War Conditions

Need to Get Started Now on Existing Problems Is as Important as It Was a Few Weeks Ago

The tumult and the shouting about an early Fall peace in Europe has died down and with it a great furore about immediate relaxation of certain controls that would allow industry to start the wheels rolling on the road to reconversion. The unexpected stone-wall resistance at the German border and the subsequent slow progress of the Allied armies have quelled temporarily the pressing demands of the automobile industry for immediate action on preferential treatment on its reconversion problems. This does not mean that the problems do not exist still and that the need to get started well in advance of V-E Day is any less paramount than it was a few weeks ago. What it does mean is that the industry now realizes that the war in Europe is not going to be finished overnight and that there are some encouraging signs that the government is trying to give whatever help it can, compatible with filling war needs, to clear the way for getting necessary preliminary work done.

The recent action by WPB in regard to machine tools, a critical phase of the automobile industry's reconversion program, is a case in point. Heretofore, the industry's orders have been unrated, with the result that machine tool builders could give no satisfactory delivery date. However, on Oct. 14, WPB announced that ratings on virtually all orders on machine tools for civilian use are to be eliminated. The net effect of this is to place the automobile industry orders on the same footing with those of other civilian industries. Furthermore, preference ratings will be assigned only to those exceptional cases where a critical bottleneck with respect to a few key pieces of machinery or equipment exists or where some other extremely urgent need for priority assistance is demonstrated. Thus, the industry will now be able to share in the 25 per cent of production that the machine tool builders are allowed to devote to orders for civilian use. Both rated and unrated orders will enjoy the same measure of protection when within 60 days of delivery.

Further evidence that the automobile industry is destined to play an important part in war production for some time is seen in the continued placement of new contract in the Detroit area. This demonstrates that the armed forces are continuing to rely on the great productive capacity of the automobile industry even after the fall of Germany, and the extent to which war work is kept in automobile plants will in large measure determine how soon and how rapidly reconversion to civilian automobile output will come. A

(*Turn to page* 58, *please*)

British Automobile Industry Reconversion

(*Special cable from London*)

It is the expectation of the British automobile industry that reconversion to civilian production will require a much shorter time than the changeover in the United States.

The Austin Company, as a striking example, according to Managing Director Lord, one of the ablest British production executives, expects to have chassis coming off its line at the rate of 400 per week one week after the go-ahead signal is given by the government.

This is a rather surprising statement since the Austin Company, largest volume producer in Great Britain, has been devoting a considerable portion of its efforts and equipment to the production of Lancaster bombers, tank transmissions and other products quite out of its usual line.

While domestic demand in the United Kingdom is expected to be good for several years, prospects in the export field are not so bright because of the cost level. American light cars can be set down in foreign ports, freight paid, at prices less than material and labor costs of British makers due chiefly to larger production volume. British total car output is normally approximately one-tenth that of American or about 500,000 units annually.

Aircraft production in the United Kingdom is expected to shrink 90 per cent after the cessation of hostilities, with the shadow plants erected and equipped by Government, but managed by private industrial concerns, closing first. Plans have not yet been disclosed regarding disposal of these government-owned properties.

First Postwar Ford Cars to Incorporate More Changes than Were Made in Yearly Revisions

The first postwar Ford cars will incorporate more changes than were made in year-to-year model revisions before the war and will not be merely a face-lifted prewar model, Ford officials announced at a recent press conference following a three-day postwar planning session held at Detroit and attended by company officials and regional managers. While explaining that the new model would not closely resemble the '42 model in appearance, Henry Ford II, executive vice president, stated that changes made would be within the limitations imposed by WPB, but that certain functional improvements made during the course of war developments would be incorporated.

Ford officials also reaffirmed a previous announcement that the company has plans for a lower priced car to be put on the market some time between the time the first postwar cars are built and the time the true postwar models are introduced. Mr. Ford stated that no definite price has been fixed for the low-priced car, but that it probably would sell for 20 to 25 per cent less than the regular Ford line.

With the avowed purpose of recapturing top place in the industry, the company will spend $150 million dollars on its postwar expansion and reconversion program. Most of the money will be spent for plant expansion, machine tools, and equipment. Plans call for reopening of all former assembly plants, and establishment of at least one more assembly plant and one more manufacturing plant. The company already has purchased land at St. Louis for a new plant and has the design ready. In addition, ten or more parts depots will be established throughout the country, with land already purchased at Denver for the first unit, which is to cost $500,000.

It also was announced that engineering facilities have been expanded and coordinated with the research department, so that approximately double the space is available for these activities.

Asked about prices for postwar cars, Mr. Ford stated that he thought the

Machining super-precision . . . IN FAIRCHILD'S "BETWEEN-THE-LENS" AERIAL CAMERA SHUTTER

Fairchild's aerial cameras for military and civilian use are built to operate at temperatures ranging from —70° to +165° F. and at speeds from 1/25 to 1/500 of a second. Because the Fairchild "between-the-lens" shutter is the heart of the camera, it must be machined with super-fine precision to insure trouble-free performance under the most extreme conditions, even including aerial combat.

For this and other close-tolerance jobs on Fairchild cameras, Lodge & Shipley's Engine Lathes were selected. One of many vital precision jobs performed by these lathes is that of optically aligning the camera lens with this special shutter.

A beam of light, projected through the lens, goes through the spindle of the lathe onto a darkened screen. Here, through a fixture adjustment, the image is brought to required focus. The operator then finishes inside and outside diameters of the shutter housings to obtain a perfectly centered lens and shutter assembly.

L & S Engine Lathes are also used for boring, facing, and threading camera shutter housings, in many cases to within .0003" tolerance.

Whether your work is standard or highly specialized, it will pay you to consult Lodge & Shipley Engineers. For further details, write for Bulletin No. Bo-503.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

L & S LATHES

ENGINE TOOL ROOM AUTOMATIC OIL COUNTRY LATHES

CPA would allow a price increase, but declined to estimate the extent. He said that such action would probably be guided by increases made during the war on truck prices. Although the company will resume production of light commercial trucks in February, no definite price structure has as yet been set up by OPA, he added.

In a move to promote a vigorous sales organization, the company has approved a committee of dealers to serve as a factory advisory group. The committee will bring dealers into closer touch with sales, engineering, and production executives who then will be able to translate general owner suggestions into a finished product.

Ray Rausch, general superintendent, said that the company is not expecting any serious difficulty in getting machines and equipment for reconversion but that manpower and materials would be the biggest problems.

Copper and Zinc to Be Plentiful, Nickel Scarce, After V-E Day

Little Hope That Restrictions on Chrome Can Be Eased Soon After the War in Europe Ends

By W. C. Hirsch

Considerable confusion prevails in the metal market regarding the availability of some non-ferrous items when the promised lifting of restriction on their use, following the defeat of Germany, comes to pass. Cutbacks are expected to have freed by that time sufficient steel rolling capacity to facilitate purchases for the manufacture of civilian items to the extent that the progress of reconversion will permit. War Production Board officials recently told members of the Industry Advisory Committee that copper and zinc would be in free supply then. Coming so soon after reiterated intimations that the copper supply situation continued rather tight, the change, while perhaps no surprise to those who took the pains to analyze the former statements more closely, is accepted as a pleasing development. According to Lewis D. Bement, of the WPB Consumers' Durable Goods Division, several hundred thousand tons of copper will be available to consumers on V-E Day. This presents a sharp contrast with the prospects for nickel, the use of which in the construction of larger airplanes will, it is feared, more than offset cutbacks in the trainer plane program. Auxiliary nickel supplies from New Caledonia and Cuba have added little to receipts from Canada, the major source of the metal. Even more disappointing have been recent receipts of chrome, military needs of which in the fourth quarter are reported to be the heaviest in some time, giving little support to the hope that restrictions can be eased after the war in Europe ends. It isn't only the extent of the supply of the various metals that causes uneasiness, but more or less definite indications from Washington that price controls must continue for some time after fighting ceases. What this leads to can be seen from the effect of a recent order of the Surplus War Property Administrator, establishing minimum prices for Government-owned aluminum scrap. These minimum prices, below which Governent agencies are not allowed to sell aluminum scrap, range from wrecked aircraft scrap at 1¼ cents per pound to 6 cents for segregated solids. The current quotation in the open market is nearer to 4 cents a pound. Moreover, the open market seems to be in good supply, at least for the time being. The fear expressed in the metal market is that prolonged control of prices will bring artificial prices all around. Some day these must be brought back to harmonize with the law of supply and demand, an unavoidable adjustment that is bound to spell losses to some one, whether it is industry or the Government. Certain it is that price control for one day longer than it is needed as a crutch for the country's economic health, is going to be decidedly unpopular.

Packard to Build Plant at Willow Run

Packard Motor Car Co. is planning to construct plant facilities at Willow Run, Mich., under a contract with the Defense Plant Corporation calling for an expenditure of $725,000. Packard officials have declined to comment on what use will be made of the facilities, stating that an announcement of details will be made when approval is obtained from Army officials. Spokesmen for the Ford Motor Co. say that the plant has no connection with the Willow Run bomber plant and that the facilities will not be located on Ford property or on the bomber plant site.

Several months ago, George Christopher, president of Packard, announced that the company would stay in the aircraft engine field after the war. Packard also has an aircraft engine experimental and test project under way at Toledo, O., instituted at the request of the Army Air Forces.

Standard Markings For Grinding Wheels

The Grinding Wheel Manufacturers Association, Worcester, Mass., has announced that beginning Nov. 1, 1944, the industry will adopt "Standard Markings for Identifying Grinding Wheels and Other Bonded Abrasives." The association has prepared a pamphlet covering the purpose and scope of the new marking system.

Proposed New York Airport to Be Largest in the World

Three-dimensional plan of the 4,057-acre, $71,636,715 Idlewild airport, to be the largest in the world, released in October. Shown: $7,500,000 administration building surrounded by three hangar groups to house and repair planes of principal airlines. Lower left tank farm for gas and oil. Lower right, seaplane base. Light lines show basis of proposed "tangential" runways and taxi strips.

A HIGH SCORE CAN MEAN GREATER ADVANTAGES *for your Postwar Products*

Test Yourself on these Questions about the Selection and Fabrication of Stainless Steels

The postwar designer will find many distinctive advantages in using Carpenter Stainless Steels in new or redesigned products. Whether he desires high strength/weight ratio for utility purposes, or extra beauty for eye-appealing consumer products, or special physicals for special jobs, these Stainless Steels can fill the bill—and do it at reduced costs.

Below, we have listed some of the questions which frequently arise in the discussion of Stainless Steel. Check your answers and compare them with those at the bottom of the page.

1 **For highly stressed structural parts, Stainless grades are readily available which provide good toughness, plus tensile strengths as high as:**

- ☐ A—400,000 lbs. per sq. in.
- ☐ B—200,000 lbs. per sq. in.
- ☐ C— 50,000 lbs. per sq. in.

2 **The maximum Rockwell hardness which can be obtained in any Stainless grade is:**

- ☐ A—C-60
- ☐ B—C-40
- ☐ C—C-30

3 **Selenium added to a Stainless alloy gives the steel:**

- ☐ A—Greater strength
- ☐ B—Ability to harden by heat treatment
- ☐ C—Easy-machining qualities

4 **Even when dead soft annealed, all Carpenter Stainless Steels run stronger and harder than soft low carbon steels by at least:**

- ☐ A—10%
- ☐ B—50%
- ☐ C—30%

5 **Which Stainless is recommended as providing greatest protection against intergranular breakdown at elevated temperatures:**

- ☐ A—Carpenter Stainless No. 4 (Type 302)
- ☐ B—Carpenter Stainless No. 4-Mo (Type 316)
- ☐ C—Carpenter Stainless No. 4-Cb (Type 347)

6 **Which of the following Stainless Steels can be hardened by heat treatment:**

- ☐ A—Carpenter Stainless No. 2 (Type 420)
- ☐ B—Carpenter Stainless No. 3 (Type 443)
- ☐ C—Carpenter Stainless No. 4 (Type 302)

7 **The corrosion resisting qualities of Stainless Steel will be impaired by:**

- ☐ A—Cold working
- ☐ B—Carburizing
- ☐ C—Immunizing

8 **In figuring the economy of using Stainless, a cubic inch of this metal will weigh less than the same volume of nickel or copper base nonferrous metals by about:**

- ☐ A— 4%
- ☐ B— 7%
- ☐ C—10%

The men responsible for the development of postwar products will find it to their advantage to have the correct answers to these and many other questions on Stainless Steels. Our 98-page book, "Working Data for Carpenter Stainless Steels", provides complete information about many Stainless Steels—tells how to use them to best advantage. For a copy, drop us a line on your company letterhead indicating your title.

CORRECT ANSWERS	
1. B	5. C
2. A	6. A
3. C	7. B
4. B	8. C

The Carpenter Steel Company • 103 W. Bern Street • Reading, Pa.

Carpenter STAINLESS STEELS

...for
Strength
Rigidity
Heat Resistance
Corrosion Resistance
Longer Product Life
Sales Appeal

BRANCHES AT
Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

Obituary

Henry May, 83, one of the founders of the Pierce-Arrow Motor Corp., died at his home Oct. 15 after a year's illness. He began working as an errand boy for George N. Pierce, later becoming Pierce's partner in the George N. Pierce Company which manufactured tricycles and bicycles. When the firm began to build automobiles, and became known as the Pierce-Arrow Motor Corp., Mr. May was elected vice-president and general manager, a position which he held until 1919.

Harry J. Bostwick, manager of the staff coordination and postwar development department of Chevrolet Div. of General Motors Corp., died Oct. 6 at Detroit. He was 45. A Chevrolet employee since 1927, he had served at regional offices at Dallas, Texas, and Janesville, Wis., before his appointment in 1941 to the position he held at the time of his death.

Peter E. Martin, first vice-president of the Ford Motor Co. from 1924 to 1941, died at Detroit Oct. 7 at the age of 62. One of the first five men hired by Henry Ford, he was credited with having an intimate knowledge of all production machinery in the Ford Rouge plant and with being instrumental in putting Ford's manufacturing ideas into operation. He retired in 1941 because of illness.

Following a long illness, William A. Baker, special representative in the Hudson Motor Car Co. sales department, died recently in Detroit at 51. National used car manager for Hudson before Pearl Harbor, he had served on a special war assignment in the Hudson purchasing department before his appointment as special representative. He was an executive in the sales department for 11 years.

Louis Renault Dies

Louis Renault, 63, pioneer automobile manufacturer, died Oct. 24 in a Paris clinic. At the time of his death, Mr. Renault was under police observation, following his arrest on Sept. 23 on a charge of having worked for the enemy.

With his late brother, Mr. Renault developed the largest automobile factory in France. The Renault works at Billancourt occupied several acres and employed up to 40,000 workers when operating at full capacity.

• AN ANTI-FRICTION WORLD

Of countless brilliant improvements created by war production, none is more deeply worthwhile, none has more of basic usefulness, than the new applications of anti-friction bearings. We of Aetna know these, for we have helped to perfect them —know their rich potential for creating a truly Anti-Friction World.

In getting ready for that new industry of peace, Aetna is helping many businesses—helping to develop new products and revitalize old ones—helping with plans to recreate war-worn plants and equipment.

Is your business ready for the Anti-Friction World? Aetna engineers can help you, too. It's an idea that deserves action —simply call Aetna, or write.

MAKERS of THRUST BALL BEARINGS, Standard and Special ANGULAR CONTACT BALL BEARINGS ROLLER BEARINGS . . . Special, BALL RETAINERS HARDENED and GROUND WASHERS

AETNA BALL BEARING MANUFACTURING CO., 4600 Schubert Ave., Chicago 39, Ill.

IN DETROIT 2:

SAM T. KELLER, 7300 Woodward Ave., Madison 8840-1-2.

Aetna BALL BEARINGS

1944 Monthly Production of Trucks and Truck Tractors*

1944	LIGHT Under 9000 lb. GVW. Civilian	Military	Total
January	.....	21,479	21,479
February	.....	21,095	21,095
March	.....	21,081	21,081
April	.....	19,481	19,481
May	.....	19,338	19,338
June	.....	20,830	20,830
July	.....	20,269	20,269
August	.....	23,441	23,441
Total—8 months	.....	167,014	167,014

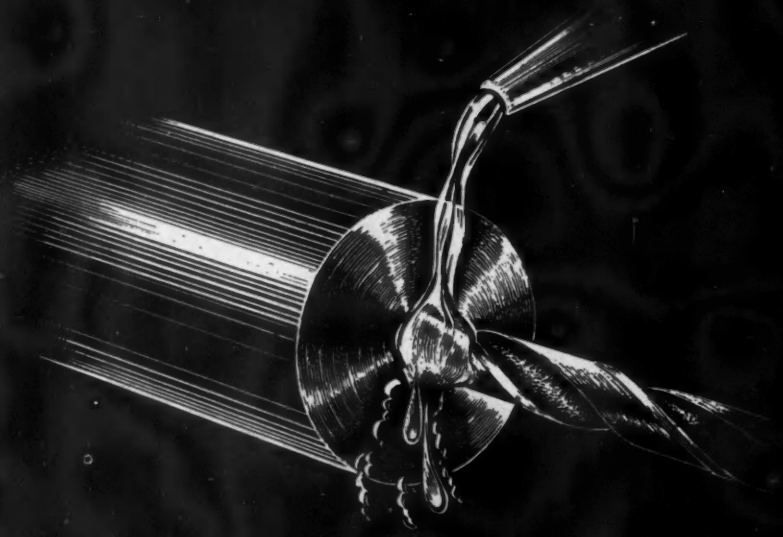
	MEDIUM 9000 to 15,999 lb. GVW. Civilian	Military	Total
January	1,985	12,806	14,791
February	1,798	9,940	11,738
March	3,317	8,303	11,620
April	6,245	6,649	12,894
May	7,310	7,007	14,317
June	9,319	6,625	15,944
July	8,582	6,031	14,613
August	10,132	5,746	15,878
Total—8 months	48,688	63,107	111,795

	HEAVY 16,000 lb. and over GVW. Civilian	Military	Total
January	543	21,783	22,326
February	968	21,870	22,838
March	1,311	22,347	23,658
April	1,906	21,438	23,344
May	1,988	21,277	23,265
June	2,607	21,805	24,412
July	2,661	23,997	26,658
August	2,246	26,855	29,101
Total—8 months	14,230	181,372	195,602

	TOTAL—ALL WEIGHTS Civilian	Military	Total
January	2,528	56,068	58,596
February	2,766	52,905	55,671
March	4,628	51,731	56,359
April	8,151	47,568	55,719
May	9,298	47,622	56,920
June	11,926	49,260	61,186
July	11,243	50,297	61,540
August	12,378	56,042	68,420
Total—8 months	62,918	411,493	474,411

* Automotive Division—W.P.B.

EXAMPLE OF *Service*:



"How to reduce tool wear in drilling operations?" . . . A manufacturer put this problem to a Cities Service Lubrication Engineer. Our engineer surveyed operations . . . recommended a special *transparent* blend of Cities Service Cutting Oil . . . *increased tool life by 25%.*

For another "Example of Service" write for *your* free copy of METAL CUTTING FLUIDS—26 pages of helpful information. Address: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

More and more, it's service that counts . . .

and *Cities Service* means good service!

CITIES SERVICE OILS — ONCE-ALWAYS

CITIES SERVICE OIL COMPANY

ARKANSAS FUEL OIL COMPANY

Stanley Awarded A.S.M. Research Medal

Robert Crooks Stanley, chairman and president of The International Nickel Company of Canada, Limited, received the A.S.M. Medal for the Advancement of Research during the annual dinner of the American Society for Metals on Thursday evening, October 19, at Cleveland.

Awarded annually to the executive who has consistently sponsored metallurgical developments and by his foresight has helped to advance the arts and sciences relating to metals, Mr. Stanley received the 1944 Research Medal because of his pioneering leadership in the field of metals research.

Division of Borg-Warner Observes 60th Anniversary

Ingersoll Steel & Disc Division of Borg-Warner observed its sixtieth anniversary in Chicago last month. Highlighting the observance of the company's milestone was a talk by Eric A. Johnston, president of the Chamber of Commerce of the United States.

Here is the New MODEL E Gabriel HYDRAULIC SHOCK ABSORBER

JUST MADE TO ORDER FOR JOBS LIKE THESE

The new Model E Gabriel Shock Absorber, fitting the gap between the widely popular Model B, and the big Heavy Duty Model F, permits you to meet every demand, Whatever your requirements might be there is a Gabriel to fit.

Gabriel MODEL B

The shock absorber that brought new fame to Gabriel... proving its superiority daily on hundreds of thousands of cars.

Gabriel MODEL F

This big, heavy duty job, for the largest commercial units, where the tonnage runs high and the going is rough and tough.

Wire or write for complete information. A trained Gabriel engineer is at your service on request without obligation.

THE Gabriel COMPANY CLEVELAND 14 · OHIO

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Somewhat further relaxation of general business activity has been indicated. The seasonally adjusted index of *The New York Times* for the week ended Oct. 7 stands at 135.5, as compared with 137.2 for the last week of September and 137.0 a year ago.

Department store sales, as reported by the Federal Reserve Board, rose from 196 to 218 per cent of the 1935-39 average in the first week of October; and the indicated value was 16 per cent above the corresponding sum in 1943. For 1944 to date, the total is 8 per cent greater than the comparable amount last year.

Railway freight loadings during the week ended Oct. 7 totaled 877,942 cars, 3.8 per cent less than the preceding weekly number and 3.1 per cent below the corresponding figure in 1943.

Production of electric power in the same period was slightly increased. The output, however, was 4.2 per cent below that of a year ago, as against a similar difference of 1.4 per cent shown a week earlier.

Crude oil production during the first week of October averaged 4,691,550 barrels daily, 70,750 barrels less than the figure for the preceding week but 301,250 barrels greater than the output a year ago.

Estimated production of soft-coal during the final week of September was 12,050,000 net tons, 1.7 per cent more than the figure for the preceding week but slightly less than the comparable output in 1943. For 1944 to date, the indicated production is 5.9 per cent above the corresponding amount a year earlier.

Engineering construction contracts awarded during the week ended Oct. 12 totaled $57,679,000, according to *Engineering News-Record*. This amount is 118 per cent above that reported for the week before but 11 per cent less than the comparable sum in 1943. The total for 1944 to date is 44 per cent below the corresponding amount a year earlier.

The Irving Fisher weekly index of wholesale commodity prices, standing on Oct. 13 at 113.5 per cent of the 1926 average, was again unchanged. The comparable figure a year ago was 111.2.

Member bank reserves increased $275,000,000 during the week ended Oct. 11, and excess reserves rose $100,000,000 to an estimated total of $1,000,000,000. Business loans of reporting members increased $15,000,000 in the preceding week but stood $186,000,000 below the total a year ago.

Black & Decker Electric Company Changes Name

The corporate name of The Black & Decker Electric Co., Kent, Ohio, has been changed to The Lamb Electric Company. Ownership of the company has been acquired by an investment group headed by the present officers of the company.

There will be no change in either management or activities, according to R. J. Lamb, president, who states that the company is planning for a greatly increased volume when civilian production is again resumed.

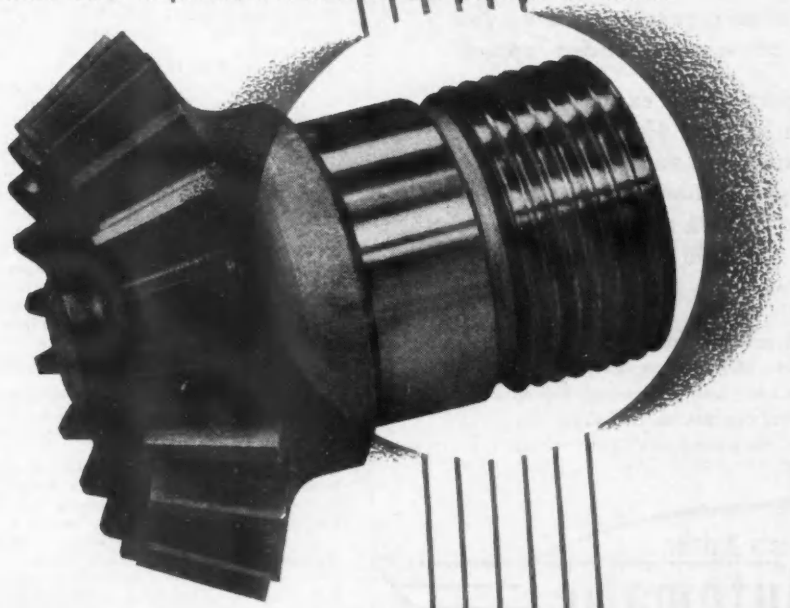
Multi-ribbed wheel thread grinding

FULLY AUTOMATIC WORK CYCLE—INCLUDING THE DIAMOND DRESSING OF THE WHEEL

WE are now equipping Jones & Lamson Automatic Thread Grinders for grinding threads and other forms, with a multi-form wheel. The scope and productive advantages of this method are greatly increased by the **FULLY AUTOMATIC WORK CYCLE OF THESE MACHINES.**

The grinding wheel is diamond dressed by an Automatic Multi-form Trueing Device; consequently an accurate, free cutting wheel is obtained, and either resinoid or vetrified wheels can be used. With this same Trueing Device, the **20-INCH DIAMETER WHEEL** can be dressed for three different methods of multi-ribbed wheel thread grinding, as well as for many varieties of plunge-cut form grinding.

The fully automatic work cycle of Jones & Lamson Thread Grinders means greater production and greater profits. Consult us for recommendations and more detailed information. Your inquiries will receive our prompt attention.



THREAD SPECIFICATION
1-3/16"—12 N.S.—Class 3

MATERIAL
SAE—4620—Heat treated

MACHINE CYCLE
20 seconds per piece—20 pieces between wheel dressings.

•

WHEEL DRESSING CYCLE
35 seconds. Controlled by electric counter, thus maintaining fully automatic work cycle.

JONES & LAMSON MACHINE COMPANY
SPRINGFIELD, VERMONT, U.S.A.

Manufacturer of: Universal Turret Lathes • Ray Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers

Intake Pipe Coupling Ring

for aircraft engines, turned from AMS 5050 steel tubing. Despite an OD of nearly 3″ and a thickness of less than ⅛″, roundness of hole must be held to .006″ total indicator reading.

Finger Spring Button

Stainless steel aircraft ignition part. Although the small body is turned down to less than 1/16″, the head measures 5/16″ across, is only .010″-.012″ thick, and must be flat within .001″.

Here's the Skill to make Precision Parts

large or small — in any quantity

Western Automatic's production ingenuity assures you extraordinary precision — at war-demanded speed!

No matter how complicated the part or how exacting your specifications, if its size falls between 1/16″ and 4 5/8″ round, Western has the men and machines, the experience and skill to produce it, in war quantities, fast. The two pieces shown life-size above are but two of thousands of parts we've been making, many to still closer tolerances. You may need this kind of service now, you'll need it post-war. We'll be glad to quote on your requirements.

Our Business . . . is the manufacture of special screw machine products to specifications. Machine capacity ranges from 1/16″ to 4 5/8″ round, with complete equipment for all types of secondary and processing operations, including precision grinding, heat-treating, hardening and pentrating.

Aircraft Products Division

Western Automatic Machine Screw Company

Elyria, Ohio, U. S. A.

Precision Parts and Assemblies Since 1873

PUBLICATIONS

A new South Bend Lathe Catalog, No. 100-D, describes all South Bend **engine lathes, toolroom lathes** and **precision turret lathes.** Engine lathes and toolroom lathes are shown in five sizes, ranging from 9 in. to 16 in. swing. Complete specifications are listed for each lathe illustration, giving capacities, speeds, feeds and dimensions.*

American Foundry Equipment Co. has issued a new booklet, **Shot Peening and the Fatigue of Metals,** which describes and illustrates the effects of shot peening on various metals. The text of the booklet is supplemented by diagrams and tables, and a 2-page glossary of technical terms defines the terms used in the publication.*

Bakelite Corp., unit of Union Carbide and Carbon Corp., has published a 12-page booklet about **Polyethylene resins and plastics.** The booklet is titled Polyethylene Resins, and describes the forms, properties, fabrication procedures and uses of this group of thermoplastic materials. Data tables are included which present graphic summaries of the plasticity, electrical properties and thermal expansion of Polyethylene resin.*

Bulletin 401-C has been issued by John S. Barnes Corp., describing their line of **hydraulic cylinders,** manufactured in conjunction with hydraulic pumps, valves and self contained hydraulic power unit.*

A booklet of standard practices for **degreasing metals** and other non-porous materials with **chlorinated solvents** has been released by E. I. duPont deNemours & Co. A number of typical degreasing machines are illustrated in the booklet, which also includes fundamentals of machine design, installation and operation which must be considered to insure safety and efficiency.*

A complete new bulletin on **D-C Solenoids** has been issued by Cannon Electric Development Co. It contains photographs of Cannon's complete line of direct current solenoids, together with tabulate data, dimensional drawings, wiring diagrams and response characteristic charts.*

Ransome Machinery Co. has issued Bulletin No. 2155, which presents the complete line of Ransome **welding and assembly positioning equipment.** Photographs, diagrams, specifications and important features of positioners, as well as load rating tables, are included in the bulletin.*

Norton Company has issued a new folder on the **Norton Bura-Way grinder.** Included in the folder are photographs of the grinder, descriptions and a page of specifications.*

A new **air conditioning** booklet has been published by Westinghouse Electric Elevator Co. It discusses how to plan postwar air conditioning to control temperature and humidity, clean the air and provide adequate ventilation and air circulation. The booklet also tells how air conditioning works, outlines the principal factors which must be considered to plan air conditioning for a specific application and pictures and describes equipment, including compressors, condensers, units and coils.*

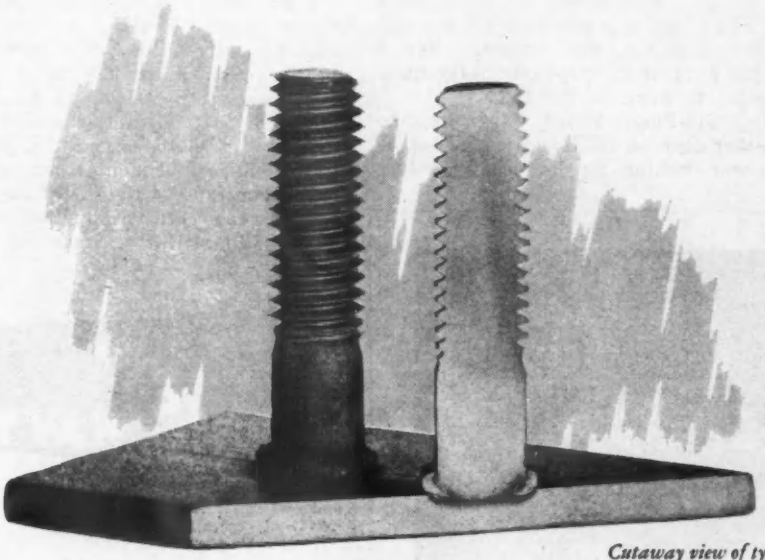
E. F. Houghton & Co. has issued two new circulars, **Houghton Products for the Metal Industries** and **Cosmoline Fingerprint Neutralizer.***

Penna. Salt Mfg. Co. has issued a new bulletin, **Heat Treating with Ammonia,** designed to aid heat treaters in the safe handling of anhydrous ammonia.*

A new catalog showing **toggle-action clamping devices** has been issued by Knu-Vise, Inc. It contains photographs of the full line of Knu-vise products, including clamps of four types, C clamps, pliers, wrenches, together with mechanical drawings showing dimensions of the various sizes and descriptions. Recommended pressures of the various models are listed.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared your name and address, company connection and title.

Complete fusion of stud to metal in less than 1/2 second!



Cutaway view of typical Nelson Stud

Nelson *Electric Arc* Stud Welding...

Now used by more than 460 industrial plants and shipyards, the Nelson Stud Welder is saving up to 75% of the time and material required when securing studs or bolts by slower methods.

The variety of Nelson Studs will fit every industrial requirement. The studs are *automatically* end-welded by the Nelson Stud Welder. No previous experience is necessary to operate it, for the timing cycle of the welding is completely controlled and consistent results are obtained. The welds produced *are stronger than the stud itself!*

The Model "H" Nelson Stud Welder

Write for complete details and catalog to:

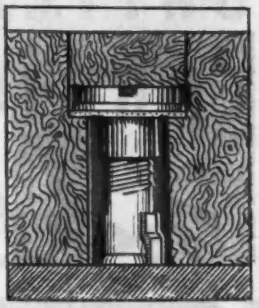
NELSON SPECIALTY WELDING EQUIPMENT CORPORATION

Dept. AV, 440 Peralta Avenue
San Leandro, California

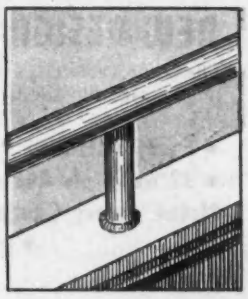
Eastern Representative: Camden Stud Welding Corp. Dept. 22, 1416 South Sixth St., Camden, N. J..

TYPICAL STUD APPLICATIONS

Nelson Insulation Pins are used to secure soft insulation rapidly and economically. They are welded directly through the material without injury to it. Where large metal surfaces must be insulated these pins will save both time and material.



Wood flooring is secured over metal beams with studs. The flooring is laid, and holes drilled where desired. Studs are welded through the holes and nuts and washers tightened down. A wooden plug is then tapped in to complete the job.



Handrails — All types may be secured with studs. Studs are shot to the metal and rail is welded to the top of the stud. Rails of this type are used many places on ships, trucks, etc. A rapid, economical way to install handrails.

Demands for Immediate Reconversion Die Down

(*Continued from page* 48)

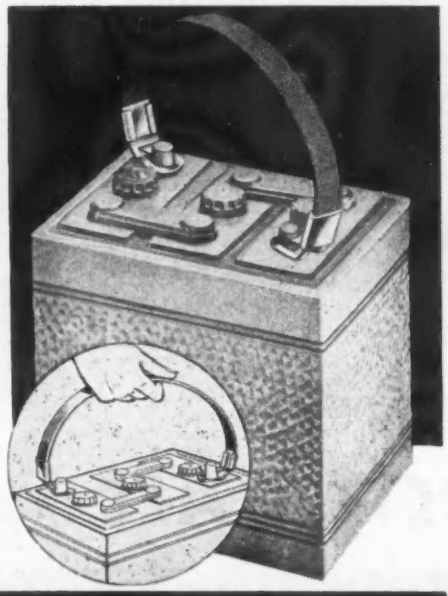
good example of how some plants will be tied up with war work is shown by the case of the Grand Rapids stamping division of Fisher Body. It recently completed tooling up for production of 155 mm artillery shells and now is in production with the peak output expected in January. In addition, the plant also is producing parts for the B-29 bomber and for tanks. There is every reason to expect that the first two items, at least, will be required in quantity for the Japanese war, with the result that the plant may be tied up for a long time to come, unless the government takes steps to move the work to another contractor. The same situation holds true for other divisions of General Motors and for practically all other car manufacturers. Hudson Motor Car Co., for example, has a major part of its production facilities devoted to work on the B-29.

Graham-Paige Motors Corp. expects to start soon on its largest contract of the war, calling for increased production of an improved model of amphibian landing craft. The company now is so deeply engaged in war work, that there is little possibility of early preparation for its announced return to the car manufacturing field. Postwar plans also call for the manufacture of tractors and farm implements.

Termination of contracts with the Fisher Body Cleveland Aircraft Division for production of a new secret fighter plane, known as the P-75, has been anounced by the Army Air Forces. Although the contract was terminated because of changes in military requirements, experimental developments will be continued. Details of the plane, which went into production several months ago, still are a military secret.

CENTRAL
Victory
BATTERY
CARRIER

Look!



NO MORE DROPPED BATTERIES

This popular, powerful battery carrier embodies a *new*, proved mechanical principle. Tension against the posts is constantly applied—even before the battery is lifted. Therefore, this carrier will not release a battery until it is actually removed from the posts by the mechanic himself.

NEW DESIGN PREVENTS SAGGING INTO ACID

The improved design keeps this heavy durable strap in a constant arc—it cannot sag into the acid and be destroyed like the ordinary carrier strap.

• Easily Attached • Quickly Detached • Inexpensive
• 32 oz. 3 ply Rubberized Duck Strap Won't Stretch • Cadmium Plated, Heavy Gauge Steel throughout • Easy on the Hands . . .
• Will Not Damage Battery Posts

2 SIZES

SHORT—For Regular Size Batteries LONG—For Long Type Batteries

MAIL COUPON TODAY FOR PRICES AND DETAILS

CENTRAL EQUIPMENT CO.
900 SO. WABASH AVE.
CHICAGO 5, ILLINOIS

Central Equipment Co. Dept. BT
900 S. Wabash Ave., Chicago 5, Ill.
Please send full details about your Central Victory Battery Carrier.
Name_____
Firm_____
Address_____
City & State_____

ARMY E NAVY

AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the Oct. 15 issue of Automotive and Aviation Industries went to press:

GENERAL MOTORS CORP., HYATT BEARING DIVISION, Clark Township Plant, Rahway, N. J.

LA CROSSE TRAILER & EQUIPMENT CO., La Crosse, Wis.

THE PHARIS TIRE & RUBBER CO., Plant No. 2, Newark, Ohio.

TRUCK ENGINEERING CORP., Cleveland, Ohio.

WESTINGHOUSE AIR BRAKE CO., THE UNION SWITCH AND SIGNAL CO., Swissvale, Pa.

★ "E" Star Awards ★

for continuous meritorious services on the prodction front have been awarded to the following firms:

KAYDON ENGINEERING CO., Muskegon, Mich.

SILENT HOIST AND CRANE CO., Brooklyn, N. Y.

ST. REGIS PAPER CO., PANELYTE DIVISION, Trenton, N. J.

CALENDAR

Conventions and Meetings

SAE Natl. Fuels & Lubricants Mtg., Tulsa Nov. 9-10

Natl. Standard Parts Assoc., Annual Fall Conference, Chicago Nov. 9-11

American Chemical Society Natl. Chemical Exp., Chicago Nov. 15-19

SAE Natl. Air Cargo Mtg., Chicago Dec. 4-6

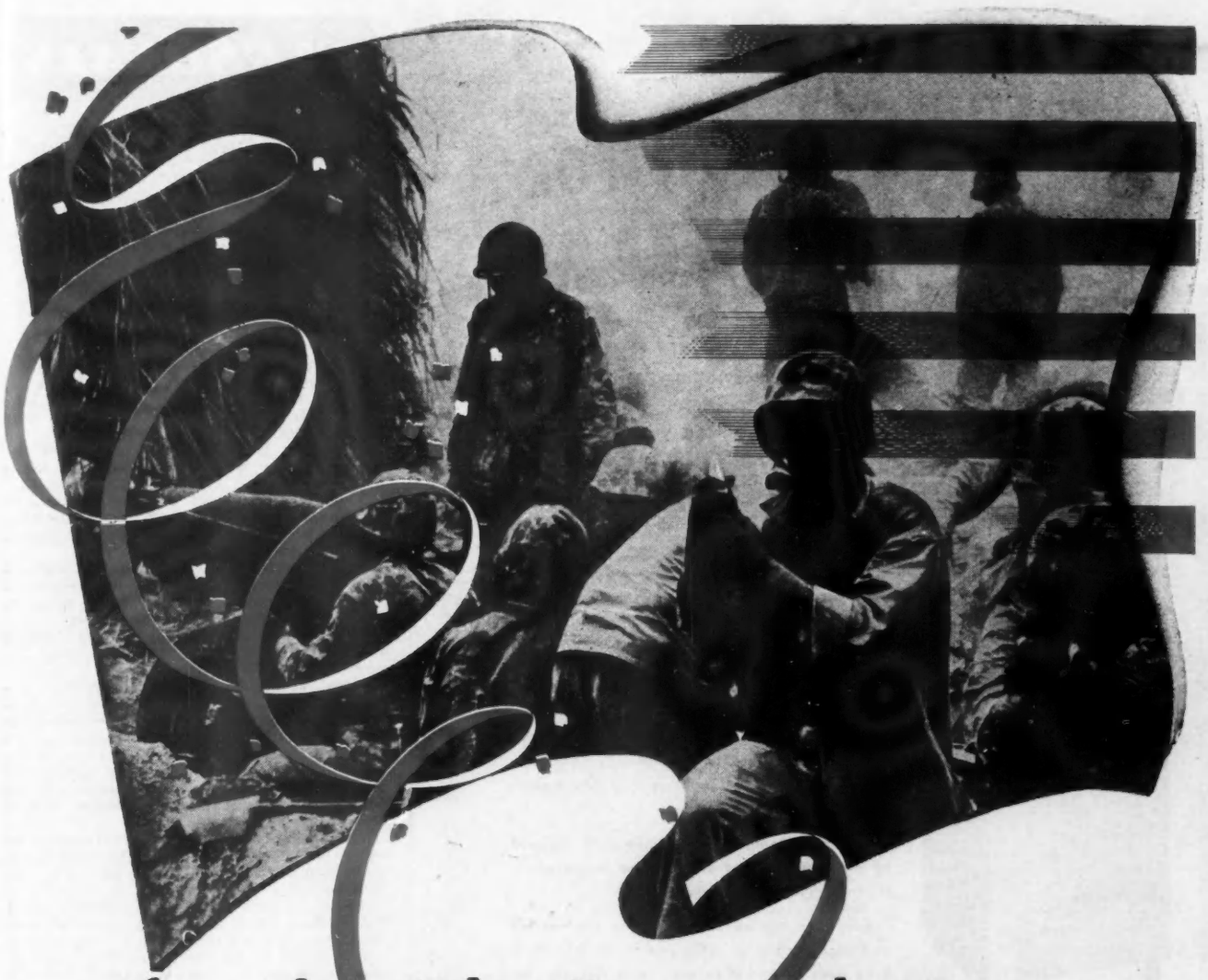
Natl. Aviation Trades Assoc., St. Louis Dec. 6-7-8

SAE Annual Meeting, Detroit Jan. 8-12

Natl. Automobile Dealers Annual Convention, Chicago Jan. 29-31

Automotive Electric Assoc., Chicago Feb. 5-12

Motor & Equipment Wholesalers Assoc., Annual Meeting, Chicago Feb. 26-28



After the Ticker Tape . . . what?

The whistles will blow, the bells will toll—we'll shower them with ticker tape and tears of joy—then what?

Then the victory they've won and all the things they've fought for will be in *our* hands to hold . . . We have all the weapons we could want: Productive capacity, technical skills, buying power, and need. How, then, could we possibly fail?

Only by lack of planning now for total peace.

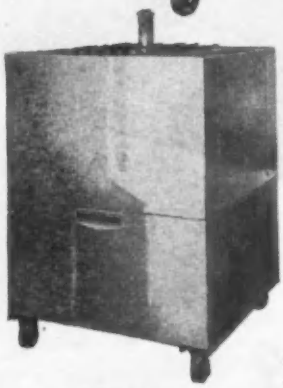
And in this critical hour of preparedness for peace, the engineers of the basic machine tool producers again have a strategic part to play.

They helped the men of government and of industry to plan the most desperate and gigantic production program of all time . . . and they can help those same men now to solve our post-war problems of reconversion.

One of these is a Bryant man. We offer his services to you.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

REFRIGERATION FOR ALUMINUM



Heat treated aluminum rivets and sheets must be kept in a dead soft condition until used or fabricated. Heat treated aluminum age hardens very rapidly at atmospheric temperatures—becomes so brittle it can't be fabricated.

But if its temperature is promptly reduced to minus 40° F. and held at that temperature, the metal remains workable.

Kold-Hold has specialized in the engineering and manufacture of refrigeration equipment to keep heat treated aluminum dead soft. This includes the refrigerated quench, the refrigerated alcohol bath, the canisters for packaging rivets, storage cabinets and mobile cabinets to take rivets to the assembly line.

KOLD-HOLD MANUFACTURING CO.
453 NORTH GRAND AVENUE
LANSING 4, MICHIGAN

If you are working with aluminum, *Write* to KOLD-HOLD for CATALOG S-Z 431

ARMY NAVY

KOLD-HOLD

PERSONALS

Charles A. Cook, formerly executive engineer for the Fuller Mfg. Co., has joined Wisconsin Axle Co., a division of Timken-Detroit Axle Co., as assistant chief engineer. He will be in charge of transmission engineering.

R. H. Anders has been appointed Assistant General Manager, Industrial Products Div., Sun Oil Co., with headquarters in Phila. **S. W. Craig,** the company's industrial products representative at Allentown, has been made manager of the Phila. Industrial Products Div., succeeding Mr. Anders.

Sun Oil Co. has also announced the appointment of **William Henry Davis** as Process Engineer, Engineering Div., Mfg. Dept. He was formerly associated with Bechtel-McCone Corp.

Harold A. Hintz has been appointed district manager of the newly opened offices of H. K. Porter Co., Inc., at Los Angeles.

The appointment of **Chester L. Shaw** as personnel director of the Warren City Mfg. Co., subsidiary of Graham-Paige Motors, has been announced.

The Weatherhead Co. has announced the appointment of **L. J. Henderson** as assistant general sales manager, and **Gene P. Robers** as sales promotion manager.

L. E. Phelps has been made direct factory representative for the Michigan Tool Co., with offices in Minneapolis.

John W. Sands, who has been with the Conservation Div. of the WPB in Washington, since January, 1942, has resumed his duties with the Development and Research Div. of The International Nickel Co., Inc.

Mid-West Abrasive Co. has announced the promotion of **Arthur G. Neubauer** to the position of sales manager in charge of jobbing sales.

The appointment of **John S. Hutchins** as executive vice-president of Ramapo Ajax, a division of American Brake Shoe Co., has been announced.

Sterling Tool Products Co. has announced the election of **J. A. Proven,** general sales manager, to the position of vice-president.

J. Howard Blake has joined The Glenn L. Martin Co. as director of market research for non-aeronautical divisions. He was formerly engaged in market research work for N. W. Ayer & Sons, Inc.

Henry G. Goehring, former assistant director of industrial relations at The White Motor Co., has been advanced to the post of director of industrial relations. He succeeds **Lon A. Fleener,** who returns to his former position as manager of the wholesale division.

Donald L. McGee has been appointed director of advertising for the Corronizing Div. of Standard Steel Spring Co.

Allison L. Bayles, of Larchmont, N. Y., has been elected vice-president of the American Engineering Co., Phila.

Alan G. Rude, vice-president of Universal C.I.T. Credit Corp., in charge of the Cleveland Div., has been promoted to the staff at the executive headquarters in New York.

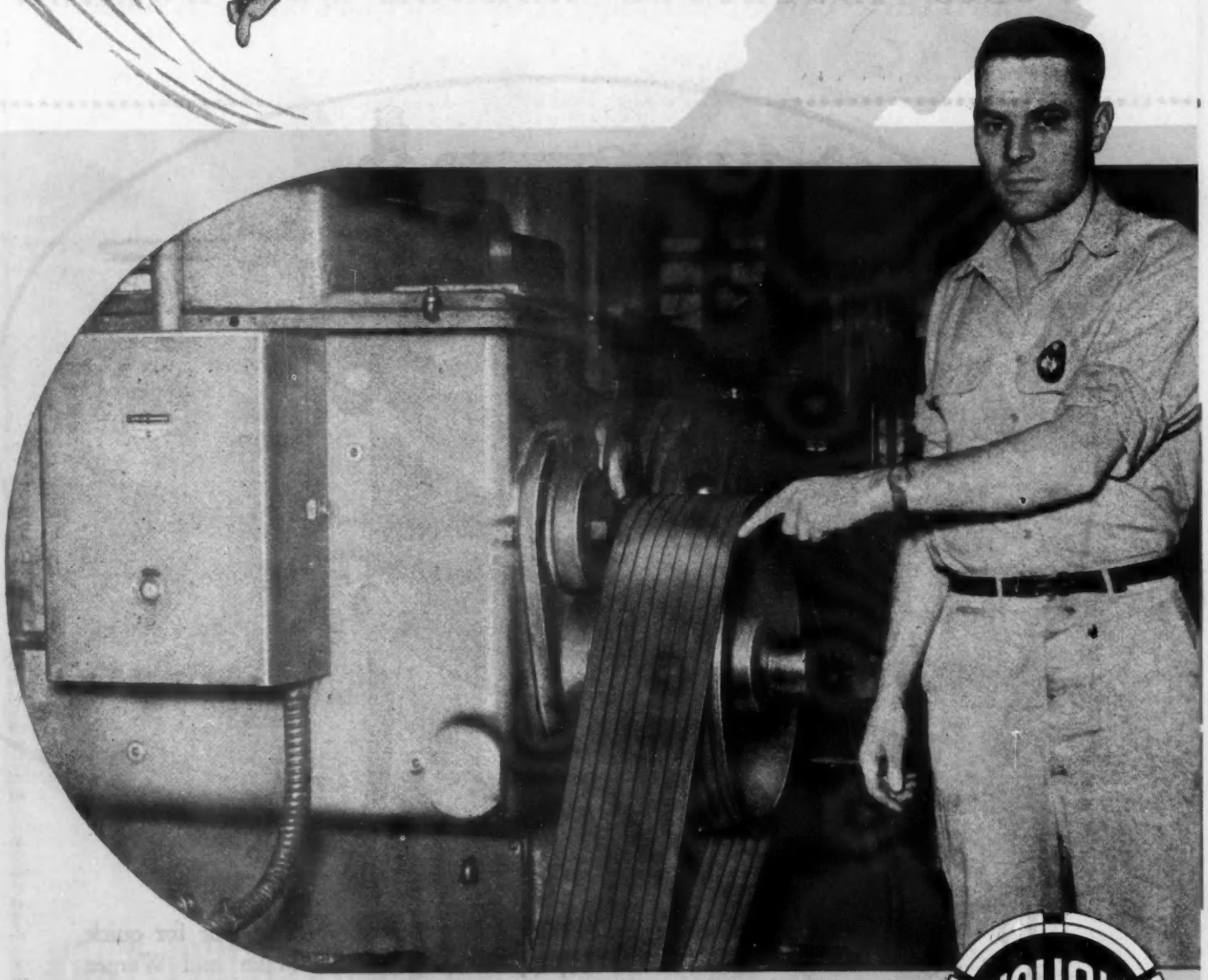
John F. Gilligan has been appointed advertising manager of Philco Corp.

Celanese Celulois Corp., plastics div. of the Celanese Corp. of America, has announced the appointment of **W. Ward Jackson** as director of the product application dept. in New York. Mr. Jackson has recently returned from Washington where he served for two years as consultant to the WPB Chemicals Bureau.

Wickwire Spencer Metallurgical Corp., subsidiary of the Wickwire Spencer Steel Co., announced the appointment of **Evelyn S. Carlson** as sales and production coordinator at the company's Newark, N. J., plant.

Appointment of **E. M. Flaherty** as manager of the Finishes Div. of the Fabrics & Finishes Dept., E. I. duPont de Nemours & Co., Inc., has been announced. **W. M. Zintl** has been made assistant manager and **W. F. Donohoe** director of Finishes Div. sales, succeeding Mr. Zintl. **Matt Denning** is assistant director of sales of the Finishes Div., succeeding Mr. Donohoe.

Don't slip on this one!

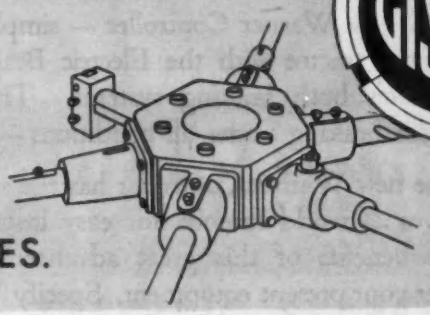


KEEP ALL VEE-BELTS AT PROPER TENSION

Slipping belts cause loss of power, excess heat and rapid belt wear.

There is no excuse for this waste with the easy belt adjustment provided by GISHOLT TURRET LATHES.

GISHOLT

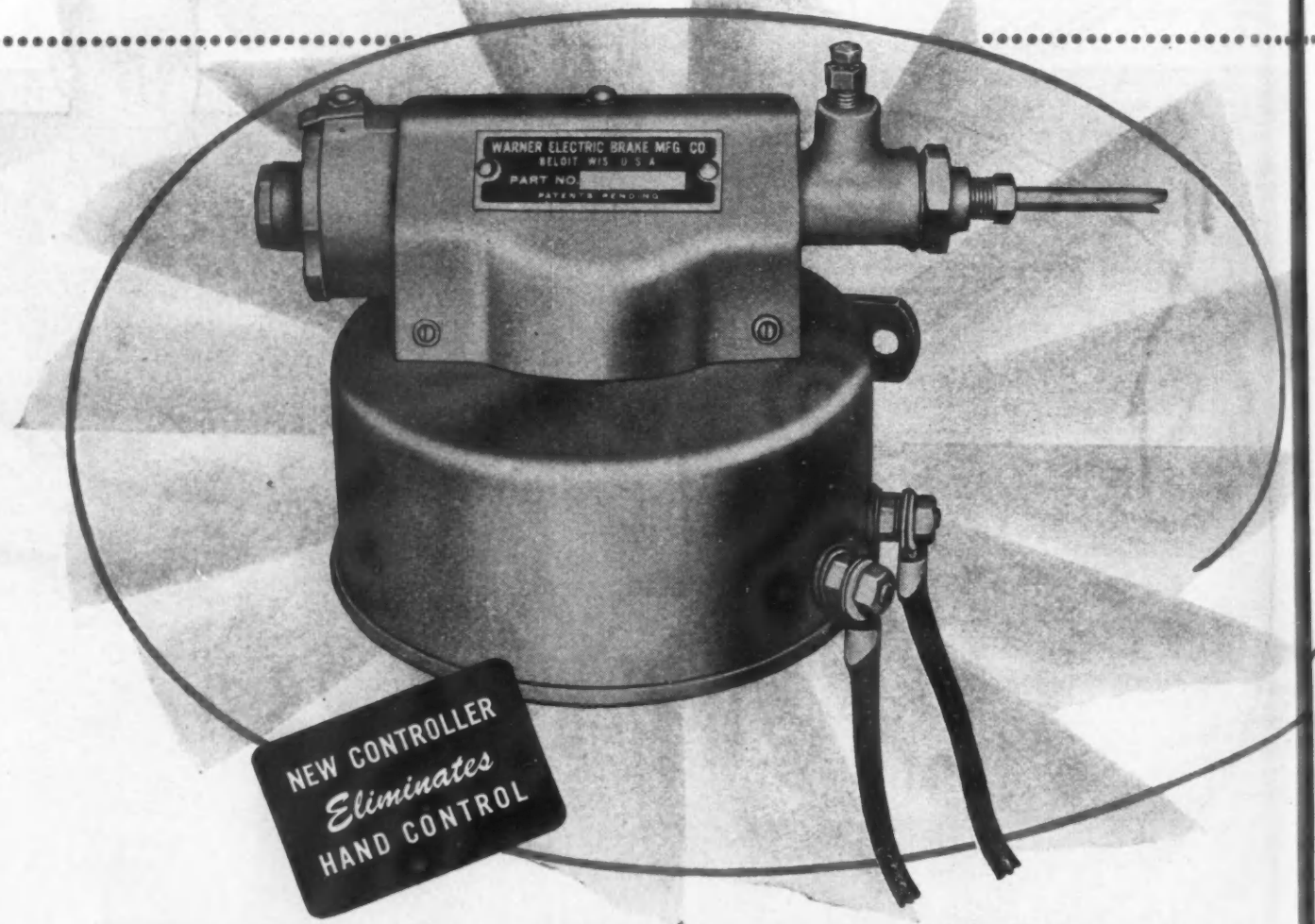


★ *Reproductions of this page on enameled paper are available for use in your turret lathe department. Write the Gisholt Machine Company, 1205 East Washington Avenue, Madison 3, Wisconsin. Ask for the series of "Wartime Care and Operation" posters. State quantity desired.*

Announcing

NEW WARNER ELECTRIC

Now INGENIOUS WARNER CONTROLLER



PERFECTED — *ready for delivery with Warner Electric Brake Systems* — or for quick change-over on tractor-trailers now equipped with hydraulic brake and Warner Electric Brake Combinations.

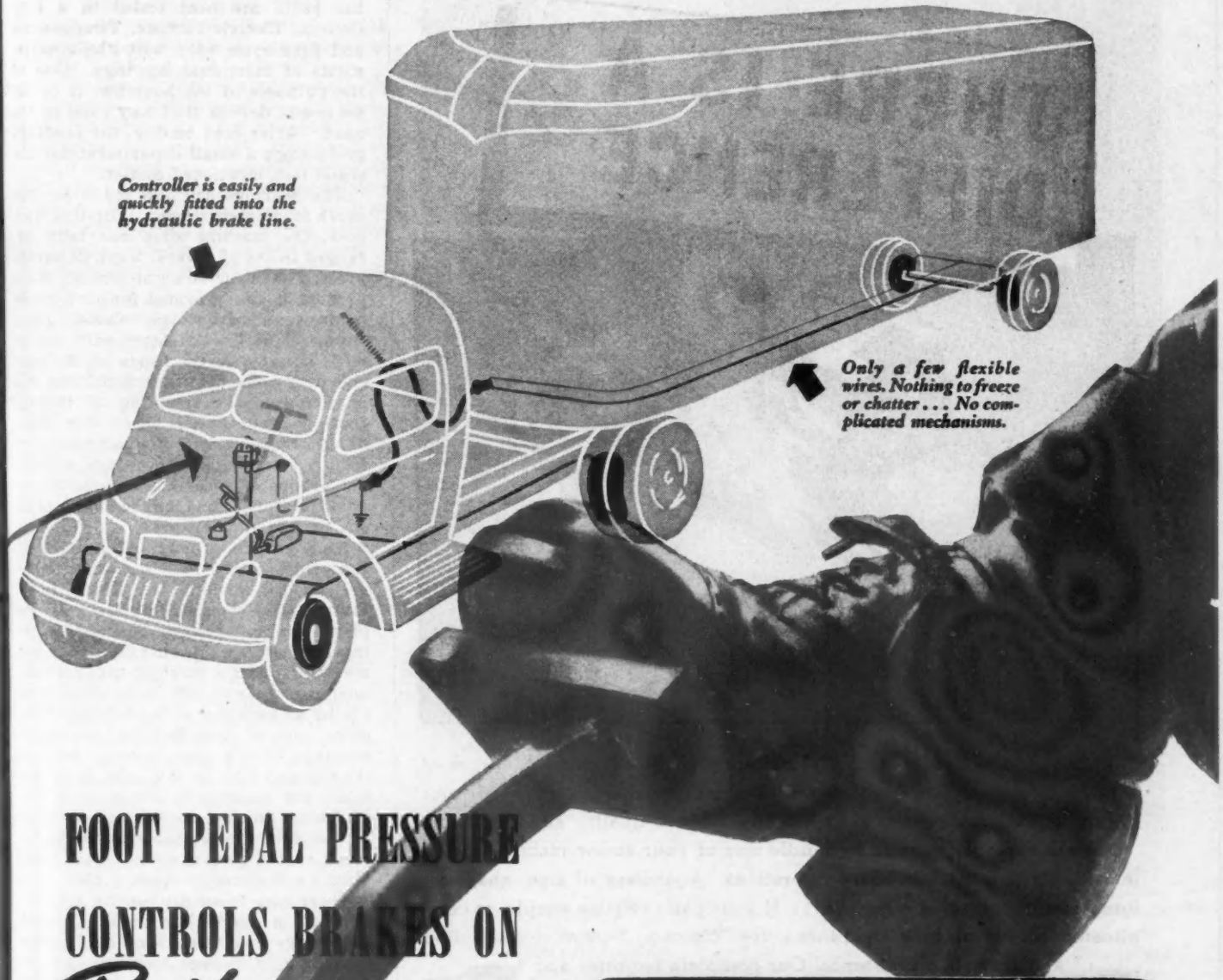
The new Warner Controller — simple and compact — synchronizes the hydraulic brakes on the tractor with the Electric Brakes on the trailer. The tractor's regular foot pedal operates both braking systems. This development creates smooth, foot-touch tractor-trailer braking under all conditions — eases driving strain — assures greater safety.

The new Warner Controller has the same basic simplicity of Warner Electric Brakes themselves — world famous for easy installation, and efficient, trouble-free performance. Get the benefits of this great advancement now. See your Warner dealer about changing over your present equipment. Specify Warner Electric Brakes on all future trailer purchases.

WARNER ELECTRIC BRAKE MANUFACTURING COMPANY · BELOIT, WISCONSIN

BRAKE ADVANCEMENT!

– *Synchronizes Tractor Hydraulic Brakes and Trailer Electric Brakes so Foot Pedal Operates them TOGETHER*


Controller is easily and quickly fitted into the hydraulic brake line.
Only a few flexible wires. Nothing to freeze or chatter . . . No complicated mechanisms.

FOOT PEDAL PRESSURE CONTROLS BRAKES ON *Both* TRACTOR AND TRAILER

WARNER
ELECTRIC BRAKES

Silver Bearings Made by Mallory

(*Continued from page* 24)

The silver plating department contains two general types of equipment, developed by Mallory. Most of the bearings are plated in so-called "rocker arm" plating tanks. Large bearings are handled in "pumper" tanks of vertical type. In preparation for process, each piece is carefully masked and mounted on specially designed fixtures, usually carrying a large number of pieces. Process tanks are arranged in rows, each row served by a trolley hoist to facilitate the movement of heavily loaded fixtures from one tank to another. A basement gallery directly below the process department contains a large variety of rocker arm plating equipment. This represents the facilities developed for initial manufacturing and now used for short order jobs.

The process department is served by a control laboratory responsible for policing the time, temperature, and current density settings of the various tanks; also for the sampling of chemical baths and maintaining them at standard conditions. A small model shop adjacent to the process department handles the design, manufacture, and maintenance of masking devices and work-holding fixtures, as well as the development of new and improved equipment. Another adjunct to the process department is the "strip" house. This is essentially a chemical salvage department. Parts which can be salvaged by selective removal of excess silver are handled here; also parts which are to be scrapped are stripped of all silver so as to salvage the precious metal.

Following the plating cycle, the work is routed to the process inspection department, concerned primarily with the quality of the plate and maintenance of specified thickness of coating. Then the parts are heat tested in a long General Electric furnace. Temperature and time cycle vary with the requirements of individual bearings. One of the purposes of the heat test is to develop any defects that may exist in the bond. After heat testing, the bearings go through a small department for the chisel test, mentioned earlier.

The bearings are now ready for the finish machining stages. For this purpose, the machine shop has been arranged in one of several ways. Separate process lines for straight-through mass production are provided for such parts as are required in large volume. Each one of these lines is fitted with equipment suitable to the needs of the specific part. The details of such lines will be found in the sampling of factory routings reproduced here. For handling a large variety of small bushings, required in job-lots, there are individual groups of specialized machines capable of quick tool change-over from one part to another.

Among the most outstanding items of equipment in the finishing department are several varieties of Heald Bore-Matics. One type of Bore-Matic is employed for the precision boring of bearings, using a cam-controlled tool bar which produces a straight tapered bore having a taper of .001 in. to .0013 in. in 1⅛ in. at each end of the bearing. The other type of Bore-Matic is set up on bearings having silver coating both on the OD and ID. In this case, both surfaces are finished in one setting, the ID being finished to the cam contour on the first stroke, the OD being finished on the return stroke. All Bore-Matics use diamond-tipped tools.

There also is an interesting application of a huge horizontal Colonial broaching machine for the spline broaching of a large bearing. This is done in two operations—a long broach for roughing, followed by changing over to a shorter broach for finishing. Blanks then are Magnaflux-inspected to detect any cracks or defects in the steel.

After semi-finish, turning, boring or facing the silvered surfaces, the silver bearing areas are again tested for plating defects. They are immersed in a heated oil bath, washed, inspected in

The knowledge, facilities and experience acquired over 72 years of manufacturing screw machine and cold upset products are applied by our highly skilled manpower to assure the highest quality and precision.

We are versatile enough to handle any of your screw machine problems, including all secondary operations, regardless of size, shape or form, and in unlimited quantities... If your parts require simple or complicated screw machine operations, try "Chicago Screw"—you'll find there is a difference. Our complete facilities and long experience provide the means and ability to meet your most rigid specifications.

ARMY E NAVY

THE CHICAGO SCREW CO.
ESTABLISHED 1872
1026 SO. HOMAN AVENUE CHICAGO 24, ILL.

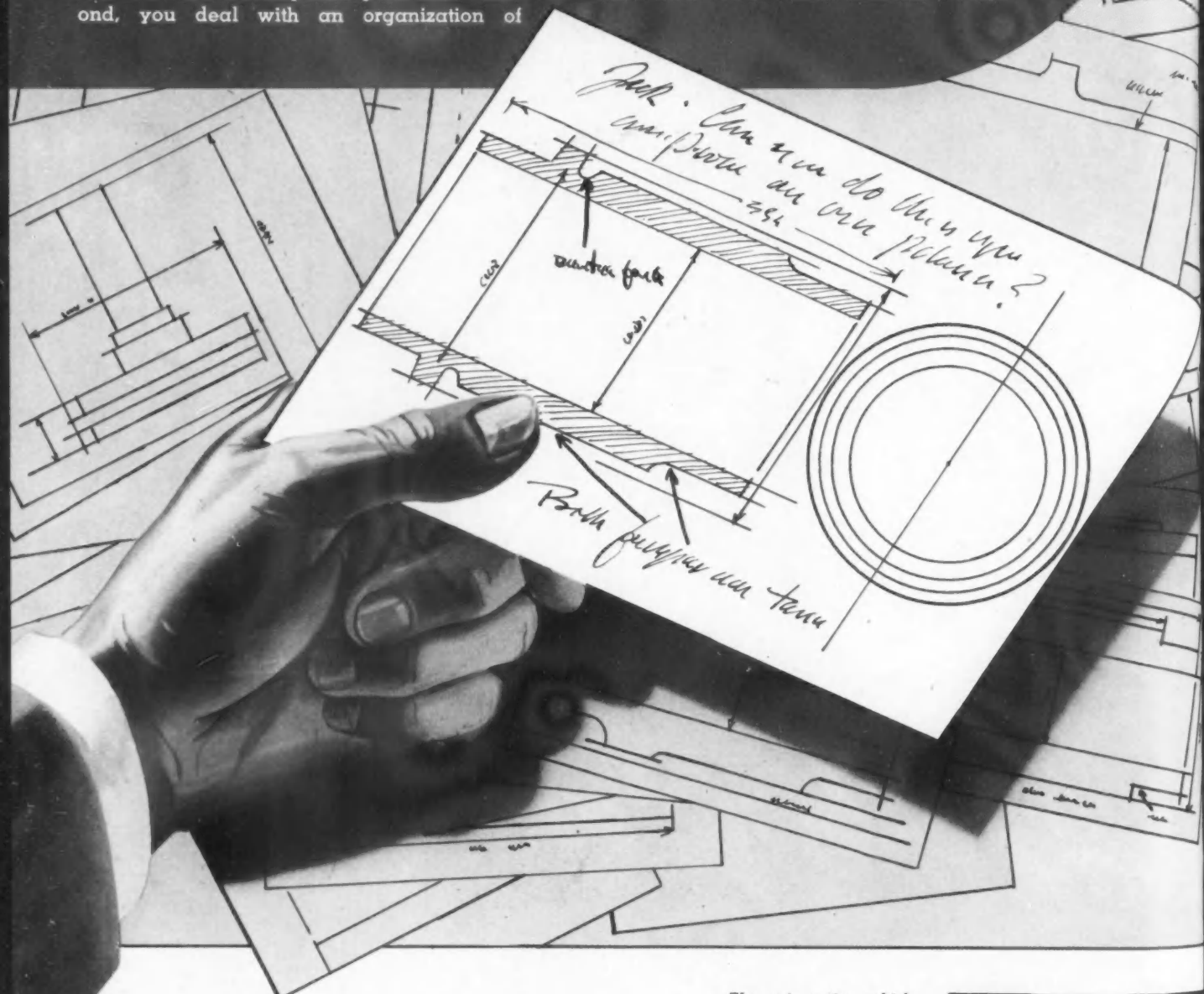
Naval Victory Off the Solomons

BY JAMES M. SESSIONS

NO. 11 OF A SERIES "HIGHLIGHTS OF WORLD WAR II" PRESENTED BY TUBE TURNS (INC.) LOUISVILLE, KY. SEE OTHER SIDE

Before you say "Impossible to forge" ...ask Tube Turns

Impossible to forge? What's preventing it? . . . a question of die design . . . forging accuracy . . . heat treat precision . . . size . . . quantity production . . . cost . . . research facilities . . . or what? If you're stymied by one of these problems, we sincerely believe Tube Turns can help you. First, we offer you the cooperation of a RESOURCEFUL engineering group that welcomes tough technical and development problems. Second, you deal with an organization of forging specialists — from executives to shop crews — with an extraordinary record in producing DIFFICULT upset forgings of steel and aluminum. Third, this manpower is supported by complete, up-to-the-minute FACILITIES for production, die making, laboratory control and research. Write US in detail about your own product and requirements . . . either immediate or prospective. Address TUBE TURNS (Inc.), Louisville 1, Ky.



TUBE TURNS *Forgings for Industry*

The epic action which resulted in our Naval victory over the Japanese in the Solomons is typified by the Sessions painting on reverse side.

the Blacklight booth for evidence of bond imperfections and the detection of pits and blisters.

Returning to the details of the finishing department, consider the setup of the job-lot departments. One group consists of a battery of 12 Heald Bore-Matics, manned by operators familiar with this equipment and capable of handling a variety of parts of different detail. Another group contains a battery of nine Brown & Sharpe automatics. Then there is a centralized grinding department with Brown & Sharpe, Norton, and Cincinnati external and universal grinders. A cluster of Lo-Swing IMP lathes is used for turning various facing and chamfering operations and the removal of steel left on for the forementioned chisel test. Too, there is a group of two Fellows gear shapers which are used for external spline operations.

Upon completion of machining operations the bearings are carefully finished by hand polishing and burring on benches.

Another interesting spot in the plant is the "sample department." It is responsible for the production development of experimental bearings as well as for the production of short order items. It is fitted with fine machinery, capable of a high degree of precision very much like a tool room. Among the equipment here are a battery of Pratt & Whitney precision lathes, Monarch lathes, Heald Bore-Matics, Norton grinders, etc.

Last stage of quality control is the final inspection department where bearings are checked 100 per cent dimensionally and visually. Here, too, the process has been specialized by setting up benches for each large volume item, thus making possible a straight line inspection, step-by-step, employing suitable items of inspection equipment. This department is provided with Sheffield gages, Electrolimit gages, and the variety of checking devices necessary to do the job.

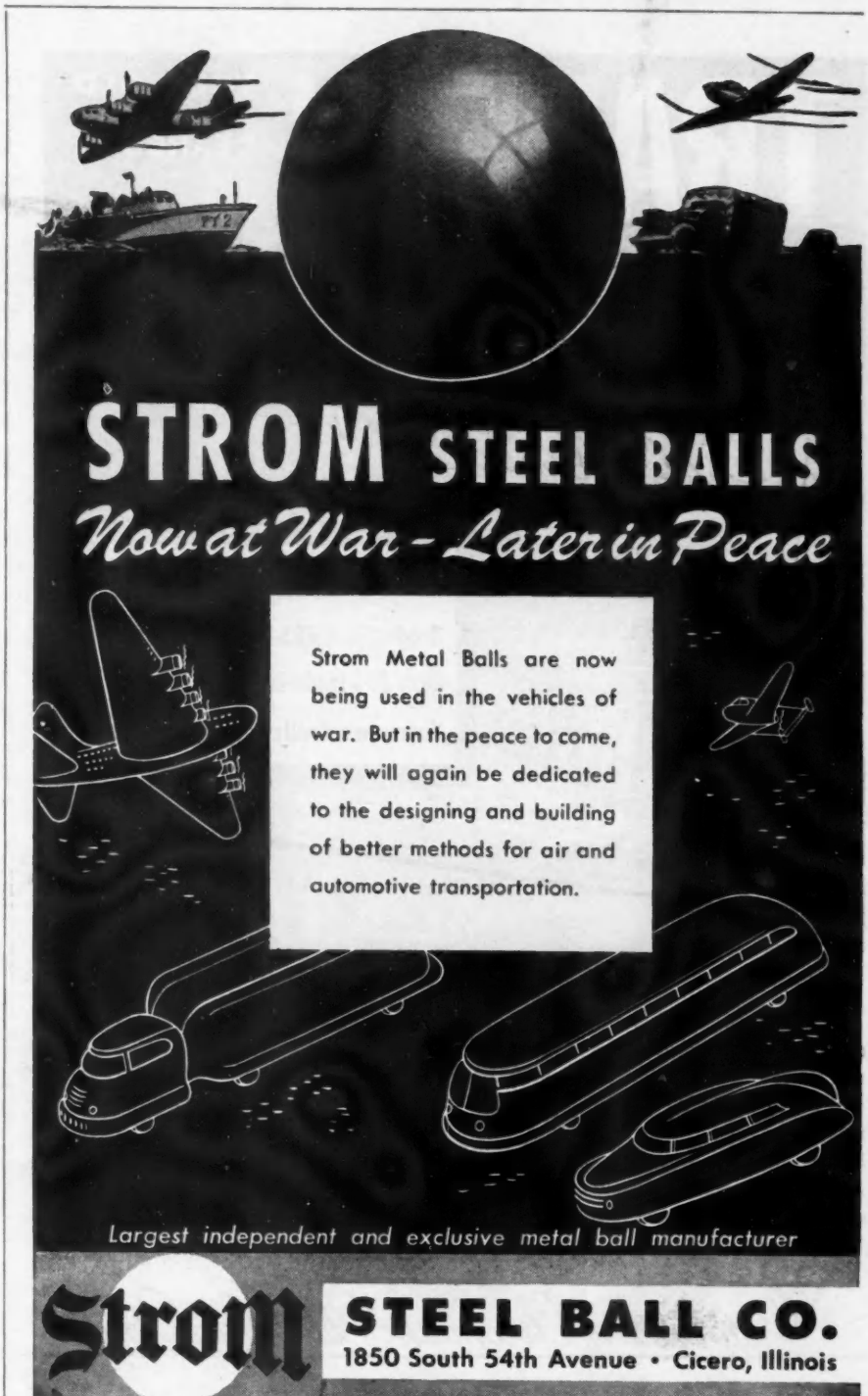
Certain of the bearings require a lead-indium protective coating over the silver. This is done in a small process department, following final inspection to assure the quality of the finished bearings, since no further machining is done after this protective coating has been applied.

It also is of interest to note that certain bearings, depending upon the number and location of silver coatings, require two separate handlings in the process department. In such instances, the bearing is finished and inspected as outlined above, then returned to the process department for second stage plating. Following this, the finishing process is again repeated.

Needless to say, where dimensional precision plays so vital a role it is necessary to provide a means of constant checking of inspection equipment. To this end, Mallory has a master gage laboratory housed in an insulated and air-conditioned room. It is fully equipped with the finest technical equipment known to the art. It contains, among other things, P & W Electrolimit gages for internal and external checking, a Bausch & Lomb Comparator, P & W Supermicrometer, Brush Surface Analyzer, toolmakers' microscopes, P & W standard length measuring machine, and other items too numerous to mention.

This laboratory functions in various ways. For one thing it is used for checking the accuracy of newly made gaging equipment before released for production. It is employed in trouble-shooting in the plant—at which time the laboratory checks machine setup, tooling, gages, as well as the product to determine where the difficulty may lie. Its major job, however, is the routine inspection of gaging equipment used in production. For this purpose, each gage is listed on a card record on which is established the frequency of checking. And this criterion depends largely upon intensity of use and character of dimensional tolerances. A representative of the laboratory makes daily trips through the plant picking up the gages in accordance with the established frequency. These come into the laboratory for checking and calibration.

(*Next page, please*)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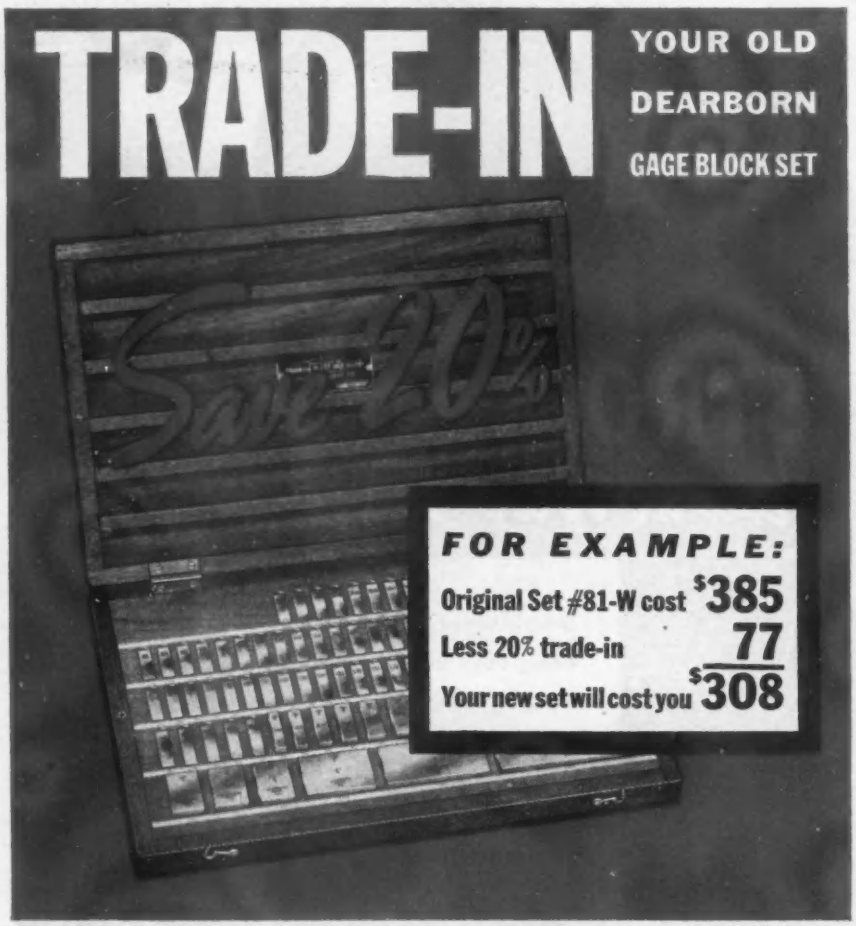
Having thus presented a generalized sketch of the operation, let us consider the details of several bearings selected as representative of the Mallory line.

Consider first the counterbalance bearing, the operations for which are given here. One feature is the large internal spline held to accurate tolerances. The OD of the silver coating is maintained concentric with the splines and square with the inside shoulder of the flange within 0.002 in. full indicator reading. The OD of the steel blank is held concentric with splines within 0.004 in. full indicator reading. This bearing is an example of the type made from a forged blank. Major stages of process are given in the routings reproduced elsewhere in this article.

One of the most delicate precision bearings made by Mallory is the supercharger bushing, the operations for which are listed here. It is silver-plated in four areas—inner and outer thrust flange faces, and on the OD and ID. Both the OD and ID are held to a total tolerance of 0.0005 in. on diameter and for mutual concentricity before lead-indium plating. After this plating, eccentricity must not exceed 0.0007 in. Runout of the inner and outer flange faces is held to total tolerance of 0.0003 in. at a radius of 1.150 in. before lead-indium plating; and a maximum of 0.0005 in. after plating. It will be recognized that such tolerances are barely within the limits of the present mass-production art. However, Mallory, with the cooperation of supplies of certain types of tools, is able to maintain production well within these limits on a line production setup.

As an example of precision strip bearing fabrication, we have taken one half shell of a bearing for an aircraft engine. It is meticulously finished not only as to the bore but as to the finish of the parting line. Note that the half-bearing height, when checked in a half-round fixture with pressure of 3500 pounds applied on the split line, is held to a total tolerance of 0.0005 in.

It may be said in conclusion that Mallory bearings represent the highest type of precision manufacture in every phase of the operation. During the relatively short space of time in which this plant has been in production, Mallory has demonstrated its ability to produce excellent quality not only dimensionally but with respect to the bonding of silver to steel, and at favorable cost levels.



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Originators of Chromium Plated Gage Blocks

Rotol Cabin Supercharger

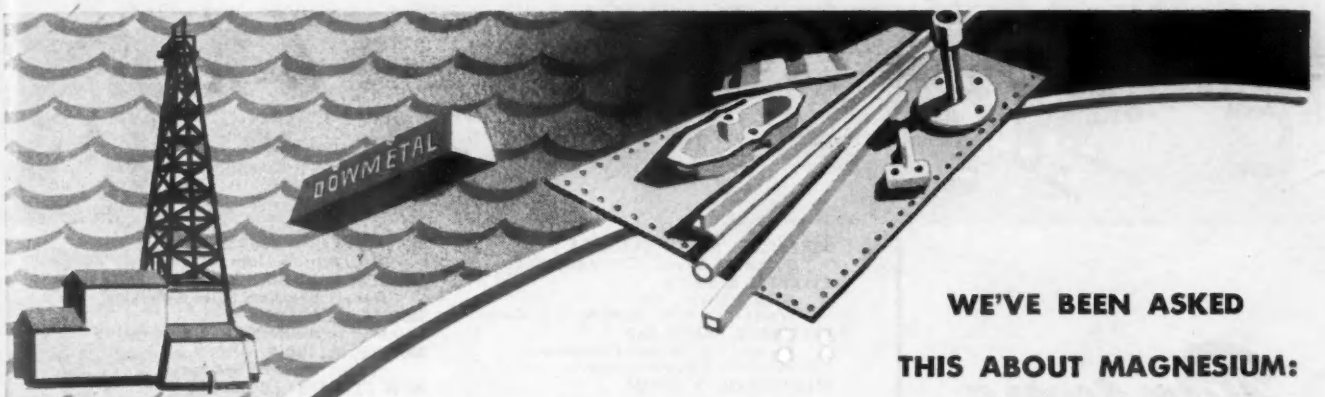
(*Continued from page* 25)

and a tongue, the latter projecting to a radius corresponding with the inside diameter of the casing, apart from a slight clearance preventing actual contact between casing and tongue.

Alongside the ends of the rotors are ports formed in the casing, one for air inlet and the other for delivery. These ports are opened and closed, to conform with the projected cycle, by the rotation of the rotors, which themselves provide an air seal when the ports should be closed. The cycle is shown in Fig. 2. In these also, and in the general arrangement drawings, the peculiar shape of the rotors is made clear.

The rotors are driven by compound gearing (Fig. 3), the primary driving gear being riveted to the inner, flanged end of a hollow coupling shaft running in dual roller bearings, the shaft itself engine-driven. The supercharger as a whole is flange-fixed to one of the engines of the aircraft; when two superchargers are fitted, one one is attached to and driven by each inboard engine.

The primary driving gear meshes with a smaller (approximately half-size) gear integral with the shaft of the upper rotor, while another gear integral with this upper shaft meshes with and drives a fourth gear wheel integral with the shaft of the lower rotor. All these gears and the two-row ball bearings at this end of the rotor shafts are located within an oil bath formed by an extension of the rotor casing. A problem that had to be



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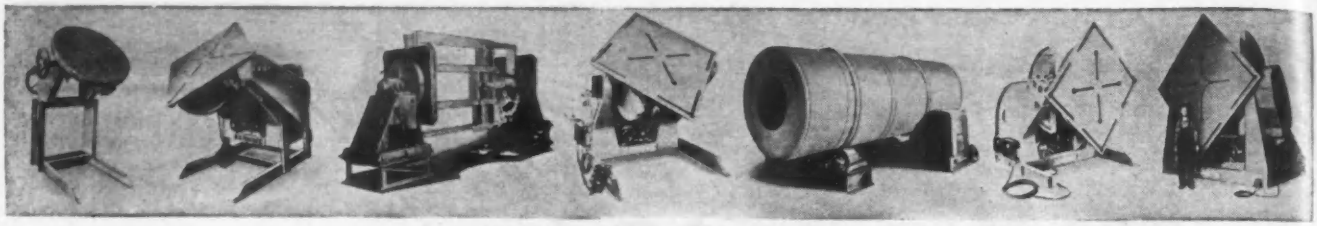

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solved in this connection was how to prevent the slightest escape of oil from the casing of the gears into the rotor chamber, for, obviously, unless the latter is kept completely free of oil the air delivered to the pressure-cabin will be contaminated. The problem was aggravated by the fact that the supercharger must be attached directly to, as well as driven by, an eingine containing hot oil.

The problem has been solved as follows: The driving gear oil seals are separated from the rotor chamber by an annular space vented to the atmosphere outside the aircraft. Between this space and the rotor chamber each rotor shaft is encircled by a non-rubbing steam-turbine type labyrinth into which compressed air is bled from the supercharger delivery. This ensures that, at all times, a small volume of compressed air flows through the labyrinth from the rotor chamber, carrying with it and through the drain to the outer atmosphere any oil that may have escaped past the conventional type of oil seal.

Heating is effected entirely by the compression of the air. Compression increases with increase in altitude, until at maximum height the air temperature at delivery may appreciably exceed 200F; this increase in air delivery temperature coincides with the drop in atmospheric temperature outside the aircraft.

To avoid overheating the cabin and lack of uniformity in cabin temperature, and to prevent passenger discomfort that might otherwise arise from either shortcoming by delivering heated air directly into the cabin at a few points, the air is passed into the cabin via the space between "double-skinned" windows of the cabin and pilot's compartment. This plan has the additional merit of preventing the windows from steaming and icing.

As previously indicated, excess of air pressure, if it does not escape to the outside atmosphere through any leaks in the cabin structure, is discharged through an automatic escape valve. In addition, the vitiated air may be discharged through the turbine gyroscopes of the various navigation instruments, so removing the need of special vacuum pumps that occurs in unsupercharged cabin aircraft.

Designs have been prepared for large postwar civil aircraft in which the passenger and crew compartments will be closed from the start of each flight and full air-conditioning provided, with refrigeration, heating, drying and humidifying installations, in addition to the superchargers, to maintain cabin conditions at comfortable ground-level conditions, irrespective of whether the aircraft is in the stratosphere, near the ground, in the tropics or in the Arctic regions.

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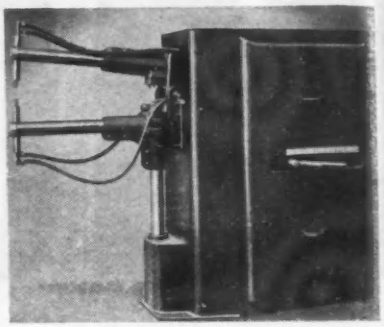
New Production Equipment

(*Continued from page* 41)

ated 360 deg, making it possible to set the vise at any angle in a complete circle. By using the horizontal feeds of the lathe's cross slide and carriage, and the milling attachment's vertical feed and angle adjustments, a lathe practically becomes a universal milling machine.

PROGRESSIVE WELDER CO., Detroit, Mich., recently added two new models to its line of storage-battery powered resistance welders. The first of these is an "economy" spot-welder of the rocker arm type, completely self-contained, with storage batteries, contactor-controller and infinitely variable heat-control regulator all enclosed in the base of the machine.

The second machine is of the heavy-duty type and designed so that both spot and roll-welding can be performed on the same machine with but minor changes. Batteries for this type of machine are housed—with contactors, battery chargers and controllers—in standardized "power-pack" units.

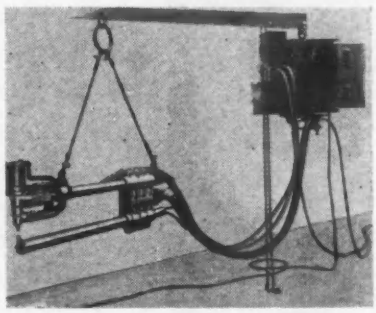


Spot welder made by Progressive Welder Co.

In addition to their ability to weld conventional steels, both models are designed to handle spot welding of such materials as stainless steel, aluminum, etc.

EISLER ENGINEERING CO., Newark, N. J., has designed portable resistance welding equipment for use where it is not practical to move bulky work to the regular production line and in places hard to reach with a stationary welding machine.

The Eisler model of a portable gun welder is a direct air-operated welding machine, equipped with a double-acting air cylinder and the necessary operating mechanism, fully or semi-automatic, depending on the choice of control. The power part consists of an air-cooled transformer, with an 8 tap switch for heat regulation (7 on and 1 off position), a pneumatic or electronic actuated timer and a high-speed mechanical or electronic contactor for accurately timing the weld in speed or automatic repeat of strokes. The weld cycle can be initiated by a foot switch or push button. The air system includes solenoid-operated air valves, air filter, pressure regulator, gage and switch and an air line oiler. The kickless cables of 500 M.C.M. are sufficiently water cooled in a single circuit. These units are manufactured in sizes from 30 to 150 kva.



Eisler portable gun welder

REIMULLER BROTHERS CO., Franklin Park, Ill., has placed on the market a new precision bench press of semi-steel construction. Incorporating "V" ways to eliminate the use of die

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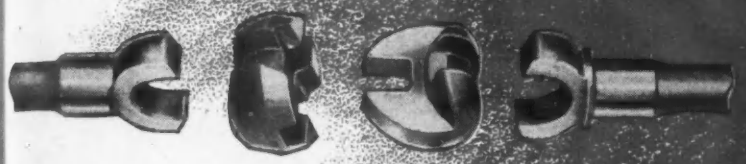

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Developed in Europe more than 15 years ago, the TRACTA JOINT is a product of the logical simplicity and practicality of French automotive engineers. New Process engineers have redesigned it to American standards—adding the physical properties of American metallurgy, the production economies of American methods, the torque capacity demanded by American automotive engines and vehicles.

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Its toughness has been proved on every battlefield. Its simplicity has been praised in countless field repair stations and ordnance depots. And its ability to function even when misalignment occurs has caused widespread surprise.

✓ Tracta Joints are especially suitable to front-wheel drives, multiple-drives, independently-sprung wheels, railroad inter-car drives, machine tools, conveyors, dynamometers, power take-offs, marine aircraft applications. Write for sizes, torque capacities, operating and test data.

This Army Jeep shows the conditions encountered by Tracta-Joint-equipped vehicles in Amchitka during the campaign against the Jap-held Aleutian Islands.

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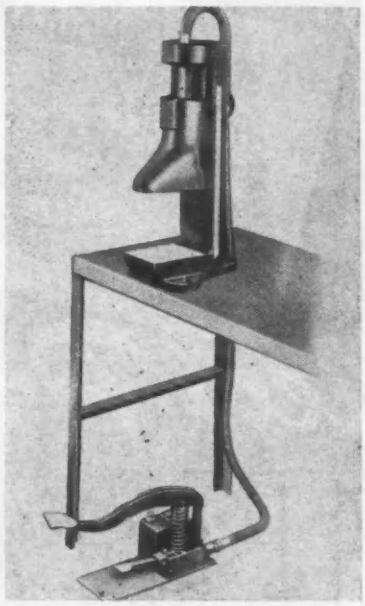

Reimuller bench press

shoes, the press is made in one size, 5 ton, and has a 5-in. by 6-in. platen with 7 in. of ram movement.

Two levers are used in the hydraulic foot control, one to apply pressure up to the rated tonnage; the other for release which has a two-speed return. No outside airline or power is needed. Operator's hands are free when operating.

The press is readily portable when mounted on a portable stand. The same machine is adaptable with proper equipment to be used as a tensile and compression testing unit up to 5 tons and as a pipe vise to handle up to 6-in. pipe, or as a shear for ¼-in. plate or ½-in. rounds.

Micromatic Introduces New Honing Equipment

RECENTLY Micromatic Hone Corp. Detroit, Mich., disclosed certain striking accomplishments in the field of honing which leave the impression of remarkable advances in the offing.

Among these major developments are: Microsize control—a unique method of sizing the work; external cylindrical honing which may be applied to long bars; progressive honing, in which two or three spindles may be used in one setup in combination with an indexing work table; ball stud honing; and, above all, a new feature of heavy stock removal, permitting the hone to replace many other conventional methods of stock removal.

Microsize control, which may be applied to any of the Micromatic equipment, depends upon three basic elements—a new type of tool construction, a unique synthetic stone holder and precision made selective sizing ring discs.

Heavy stock removal holds promise of remarkable developments among methods of machining. It has been

PLENTY OF "WHAT IT TAKES"

To Lick Aviation Crash Fires

Shielded behind a cooling screen of inert carbon dioxide, Cardox Airport Fire Trucks drive right up to the fire . . . enabling rescue squads to enter the plane within seconds after the truck arrives.

Quick Knock Down of Heat and Flames a Big Factor in Rescue of Plane Personnel!

• When an airplane crashes and burns, flames fed by highly volatile aviation gasoline sweep with appalling suddenness over the ship and trapped personnel.

Cardox Airport Fire Trucks now on the job at major airfields throughout the U. S., are engineered for the one specific job of quick extinguishment of even very large aviation crash fires . . . so that plane personnel may be rescued and costly equipment salvaged. Backed by the tremendous extinguishing capacity of *3 tons* of zero-cold carbon dioxide, the Cardox Airport Fire Truck "blitzes" fire with a mass discharge of inert vapor and CO_2 snow (dry ice at 110°F.). If necessary, the entire 3 tons can be discharged in a cooling, smothering blanket in approximately 1 minute!

Carbon dioxide, one of the fastest of all extinguishing mediums, is given enhanced fire extinguishing performance through Cardox control and engineered application. Discharged at an extremely high rate into the heart of the blazing inferno, it knocks down heat and flame so quickly that usually within *seconds* after extinguishment is begun rescue squads can enter the plane.

Extinguishing characteristics of Cardox CO_2 are uniform, regardless of atmospheric temperature . . . assure peak performance under all weather conditions. Cooling effect, effective projection and "reach" are augmented, even in strong winds, because of the higher yield of comparatively heavy CO_2 snow, characteristic of the Cardox discharge.

Write for Bulletin 4104, and free reprint of address "Fighting Airplane Crash Fires" by B. M. Doolin, as Manager of the San Francisco Municipal Airport at the 47th Annual N.F.P.A. Convention.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

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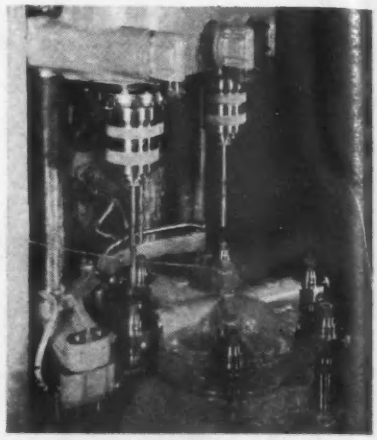
demonstrated on the ball stud operation and in the finishing of cylinder blocks and cylinder sleeves. One of the potential applications is in the preparation of gear blanks. Essentially, the use of Microsize technique is said to make possible the removal of as much as 0.030 in. with a hone for the roughing operation and yet maintaining a high order of accuracy and fine surface finish. On ball stud honing, Micromatic reports that 0.030 in. has been removed from a previously turned and heat-treated forging. This was accomplished with an accuracy of 0.0001 in. and a surface finish of 2 to 5 microinch.

External cylindrical honing on hardened and ground shafts from 1-in. diameter and upward is said to have shown stock removal of 0.0015 to 0.002 in. in two operations, with accuracy within 0.0003 in., and surface finish from 1.5 to 2 microinch.

Progressive honing is a technique developed with the use of the Micromatic multiple-spindle Hydrohoner provided with Microsize control. It embodies Microdial feed control and automatic, rotary indexing of the work. The illustration shows one setup, using three honing spindles—rough hone at one station, semi-finish at the second, finish hone at the third. This method is recommended for maximum stock removal ranging from 0.007 in. in ¼-in. bores to 0.010 in. for 1-in. bores. For stock removal of about 50 per cent less than this, two spindles are recommended—one for roughing, the other for finishing, with a cooling station in between. This method is said to be particularly adapted the finishing of bushings, valve bodies, connecting rods, pinion gears, Diesel fuel injectors, etc.



Micromatic Microsize Hydrohoner for progressive honing of precision parts.

For cylinder honing or the finishing of cylinder sleeves of large diameter with maximum stock removal, Micromatic is offering its new line of vertical Hydrohoners with Microsize control, used in conjunction with the Hydrobrake tool. The tool—key to the principle of heavy stock removal combined with extreme accuracy of bores—is said to offer the following advantages: it can be used with mechanical or hydraulic feed control; fewer heads can be used for a larger range of body and driveshaft assemblies; can hone long bores with shorter tool; manual operation, if desired, on hydraulic machines.

It is pointed out that innumerable applications of the techniques mentioned above can be developed for the automotive industry for postwar use as the need arises.

Graham-Paige Plans For Post-War Cars

When Graham-Paige Motors Corp. re-enters the automobile manufacturing field after the war, it will be with a completely new design utilizing plastics, light metals, and other recent developments, according to Joseph W. Frazer, chairman of the board. He conceded that because of present heavy war commitments and the longer time involved in engineering a completely new design, the new car will not be ready for sale until several months after other manufacturers, who will produce conventional 1942 models, have resumed production. Graham-Paige, he said, is planning to take advantage of the plants and know-how of small manufacturers whose facilities have expanded greatly during the war.

Now! A Full Range of Littelfuse Fuse Extractor Posts

AVAILABLE FOR ALL THESE FUSES:

3 A G and 3 A B
1¼" x ¼" dia.

4 A G and 4 A B
1¼" x 9/32" dia.

5 A G and 5 A B
1½" x 13/32" dia.

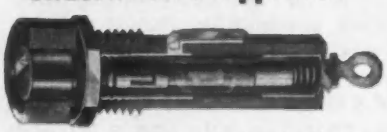
8 A G
1" x ¼" dia.

Hi-Amp Fuses

•

Fusible Binding Posts
Fusible Meter Posts

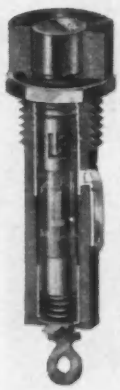
Underwriters' Approved



Extractor Post No. 341001 (Old No. 1075-S) for 3 A G and 3 A B fuses. Tool-operated.

Extractor Post No. 342001 (Old No. 1075-F) finger-operated.

Send for New Littelfuse Extractor Post Bulletin. For heavy duties to most delicate instruments.



Advantages Over Open Mountings

Occupy little panel space. Fuse replacement from front of panel.

Shield fuses from ambient temperatures. Fuses blow more consistently at ratings.

Most convenient means of changing fuses. Shock-proof.

Fuse not lost by dropping out. Can be removed from knob only by hand.

For *TODAY'S* FUSE PERFORMANCE, PROTECTION, EASE OF HANDLING

Electrically welded side terminal integral with inside metal shell, resistant to extremes of heat, shock and vibration. Knob and body molded black bakelite, impervious to temperature changes and moisture—the most thorough insulation. Spring-activated contact maintains positive and continuous contact. Fuse grip permits full visual shock-proof inspection. Fuse changes made safely, swiftly and easily.

Complete Circuit Protection

Write or wire Littelfuse on any of your circuit protection problems in old or new equipment. Complete engineering data on Fuses, Fuse Clips, Fuse Panels, Circuit Breakers, Thermocouples, Fine Wire Products, Indicators, etc. Address nearest office.

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200 Ong Street • • El Monte, California
4757 Ravenswood Ave., Chicago 40, Illinois

Improved Formulation for

HEAT-RESISTANT "LUCITE" MOLDING POWDER

(Methyl Methacrylate Resin—HM-122)

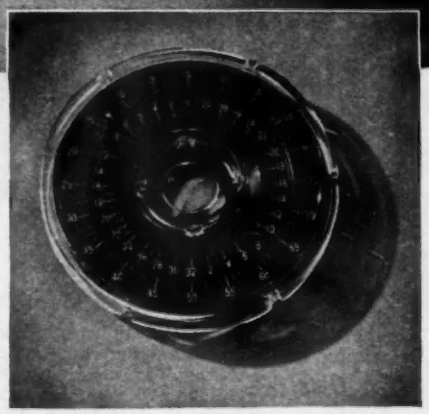
Offers you heat-resistance, greater clarity, optical improvement

THIS NEW heat-resistant molding powder, which is an improved formulation, provides heat-resistance 30 to 40° F. higher than ordinary acrylic molding powders. It has already been used on a wide variety of wartime products, ranging from a lighting guide on an air-borne sextant to parts of an Army tank directional indicator. Although it is not intended to replace general-purpose "Lucite," except where heat-resistance is a major factor, so extensive are the possibilities of application, it promises to widen the field of use of acrylics in the post-war period.

SPECIAL PROPERTIES:

- **Higher Heat-Resistance.**
- **Optical Improvement.**
- **Greater Clarity and Improved Brilliance.**
- **Increased Dimensional Stability.**

DIRECTIONAL INDICATOR: Support plate (1), originally machined from a block of "Lucite," is now injection molded of HM-122 powder. Dial cover (2) also is molded of this new formulation. Among the advantages considered when "Lucite" was selected for these parts were the speed of production, the reduction in weight of the instrument, the interchangeability of unit parts, and the fact that the cost of the plastic unit is less than half the estimated cost of the metal parts originally considered.



HEAT-RESISTANT "LUCITE" is another example of how Du Pont technicians are helping the plastics industry to produce better molded pieces more quickly, at less cost—and how they are helping to supply actual users with improved materials to meet their broadening requirements.

WRITE for free booklet giving comparison of optical, mechanical, electrical and molding properties of formulation HM-122 and general purpose "Lucite." Address: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J., or 5801 S. Broadway, Los Angeles 3, Calif. In Canada: Canadian Industries, Ltd., Box 10, Montreal.

Great stars and great radio plays make great entertainment—tune in "Cavalcade of America"—NBC network—every Monday evening.

DU PONT

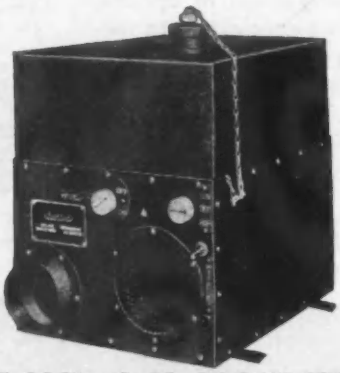
DU PONT PLASTICS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

fluid heat
TRUCK HEATERS DO
a 4-Way Heating Job!

Fluid Heat's Model SAV-25-110

This model illustrates the flexibility of Fluid Heat's heat engineering know-how. Designed by request for use in trailers housing mobile laboratories, it operates on 110 A. C. and delivers 25,000 BTU per hour. Fuel is drawn directly from the tank of the vehicle. Dimensions are $17\frac{15}{16}$ by $10\frac{1}{4}$ by $12\frac{1}{16}$ inches.



Fluid Heat's Model SAH-15T

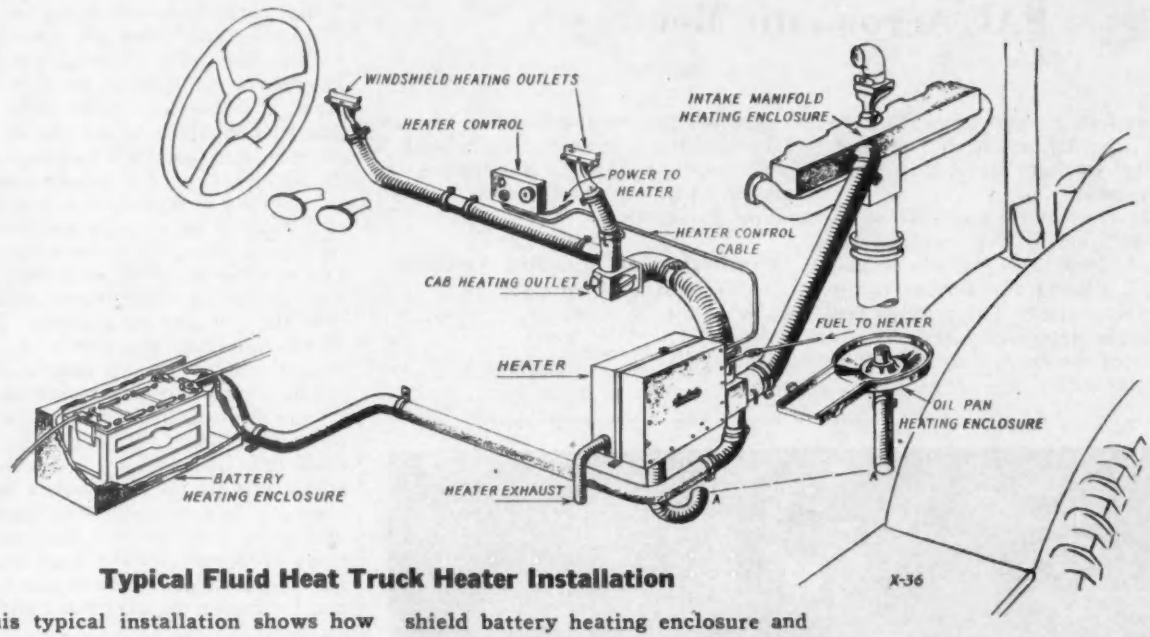
Designed for trailer and cargo-space heating, this model has an output of 15,000 BTU per hour and has a convenient hand-replenished fuel tank compactly built onto the top. Built-on tank makes the heater a completely independent, self-contained unit, permitting uncoupling of trailer without fussing with fuel lines.

FLUID Heat Truck Heaters do a four-way heating job on trucks, trailers and busses. They warm the operator's cab and defrost windshields, heat cargo or personnel space, produce quick and effortless cold-weather starting by preheating batteries, engine manifold and crank case. Mounted on wheels or runners, they preheat engines of bulldozers, cranes, compressors and other machinery where heat is an aid to starting or operating. They are ideal for vehicles where men or machines require heat to operate most efficiently and economically.

Fluid Heat Truck Heaters fit compactly in the chassis, or in cargo or living space. They control from the heater itself or from the dash. They burn any grade of gasoline, drawing direct from the vehicle's fuel supply or from built-in fuel tanks of their own. The new and exclusive combustion process of *vapor entraining*, proved in Fluid Heat Aircraft Heaters, assures maximum combustion efficiency, freedom from lead oxide formation, longer life for burner parts. There are only three moving parts—motor, fan, standard automotive-type pump.

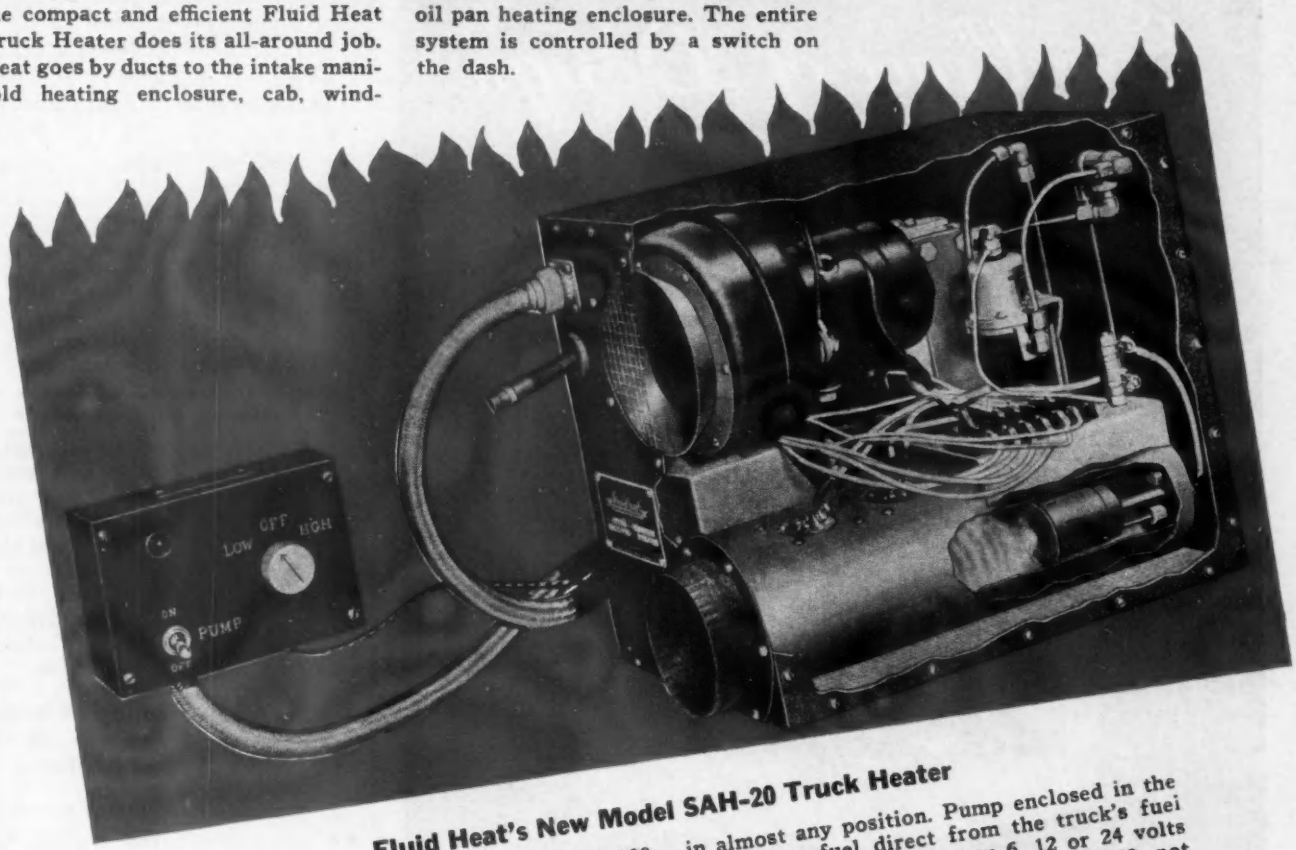
Fluid Heat has, for sixteen years, pioneered in the development and manufacture of automatic combustion and heat transfer equipment. Those years of heat engineering know-how are built into each compact, economical, efficient Fluid Heat Truck Heater. You'll want Fluid Heat Truck Heaters on the trucks, trailers, busses, cars or other vehicles you design, build or equip. Write for full information on this new heat engineering achievement.

FLUID HEAT DIVISION
Anchor Post Fence Co.
6740 Eastern Ave., Baltimore 24, Md.



Typical Fluid Heat Truck Heater Installation

This typical installation shows how the compact and efficient Fluid Heat Truck Heater does its all-around job. Heat goes by ducts to the intake manifold heating enclosure, cab, windshield battery heating enclosure and oil pan heating enclosure. The entire system is controlled by a switch on the dash.



Fluid Heat's New Model SAH-20 Truck Heater

This heater has a maximum output of 20,000 BTU per hour, yet weighs only 21 pounds, fits easily on any truck. Overall dimensions are 7¼ inches wide, 10½ inches high, 12 inches long. To insure clearance, heater can be placed in almost any position. Pump enclosed in the unit draws fuel direct from the truck's fuel tank. All models operate on 6, 12 or 24 volts D. C. or 110 volts A. C. Model SAH-40, not shown on these pages because it is identical in design, delivers 40,000 BTU per hour. It is 13 inches by 10½ inches by 19 inches, weighs 40 pounds.

fluid heat
TRUCK HEATERS

SAE Aeronautic Meeting

(*Continued from page* 39)

diately indicated the necessity for grouping related function units requiring regular overhaul on quickly interchangeable panels.

The frequency of regular service, inspection, and removal for overhaul was determined from records of trouble frequency gathered for similar equipment now operating. The selected frequency factor determined the relative importance of the desired change in the design compromise.

Another type of serviceability change determined in this survey is the seldom occurring but hard to accomplish replacement of structure subject to high vibratory stresses.

Prediction of Engine Cooling Requirements

By William M. S. Richards,
Assistant Project Engineer,
and Frank H. Erdman,
Senior Test Engineer, Wright Aeronautical Corp.

THE correctness of using a cooling correlation based on the leaving, rather than the entering, air density has been established in this paper. Here, however, the value of it is emphasized by pointing out the relatively large cooling penalty which may be predicted by this method as compared with that based on the entering density. For this purpose an example is worked out in Fig. 8 using both the entering air and leaving air correlation methods. It may be seen that the curves coincide in only the low altitude regions. The example selected represents a severe, though not abnormal, cooling load at sea level, in order to demonstrate clearly the radical differences which may occur at altitude. With lighter cooling loads the discrepancy is smaller, but will never disappear. Such a behavior seems to be consistent with flight data and bears out the fact that at conditions of severe cooling load and high altitude, a small change in any variable can represent an important change in

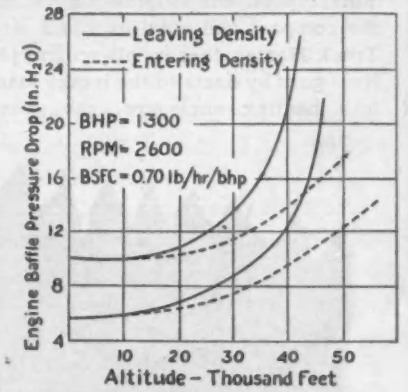


Fig. 8. Comparison of leaving and entering density methods

the required engine baffle pressure drop.

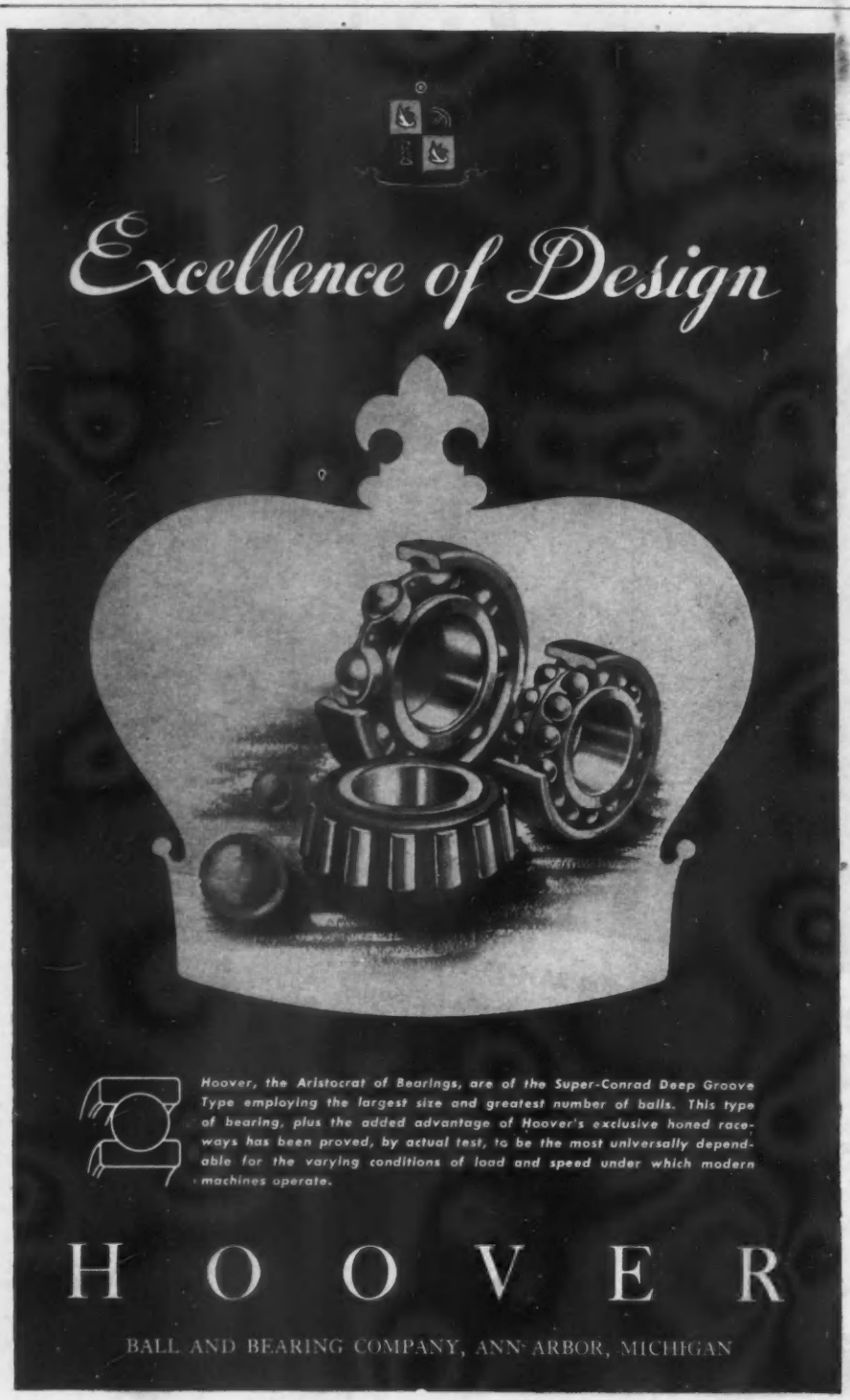
Modifications of fins and baffles to reduce temperature rise and pressure drop of cooling air along the fin passage greatly modify the severe altitude penalties shown. Research on such modifications was initiated early in 1943 as a result of this analysis, and some of the more readily applicable changes are now in production.

A Means for Warning of Incipient Breakdown of Smooth Air Flow Over Airfoil Surfaces

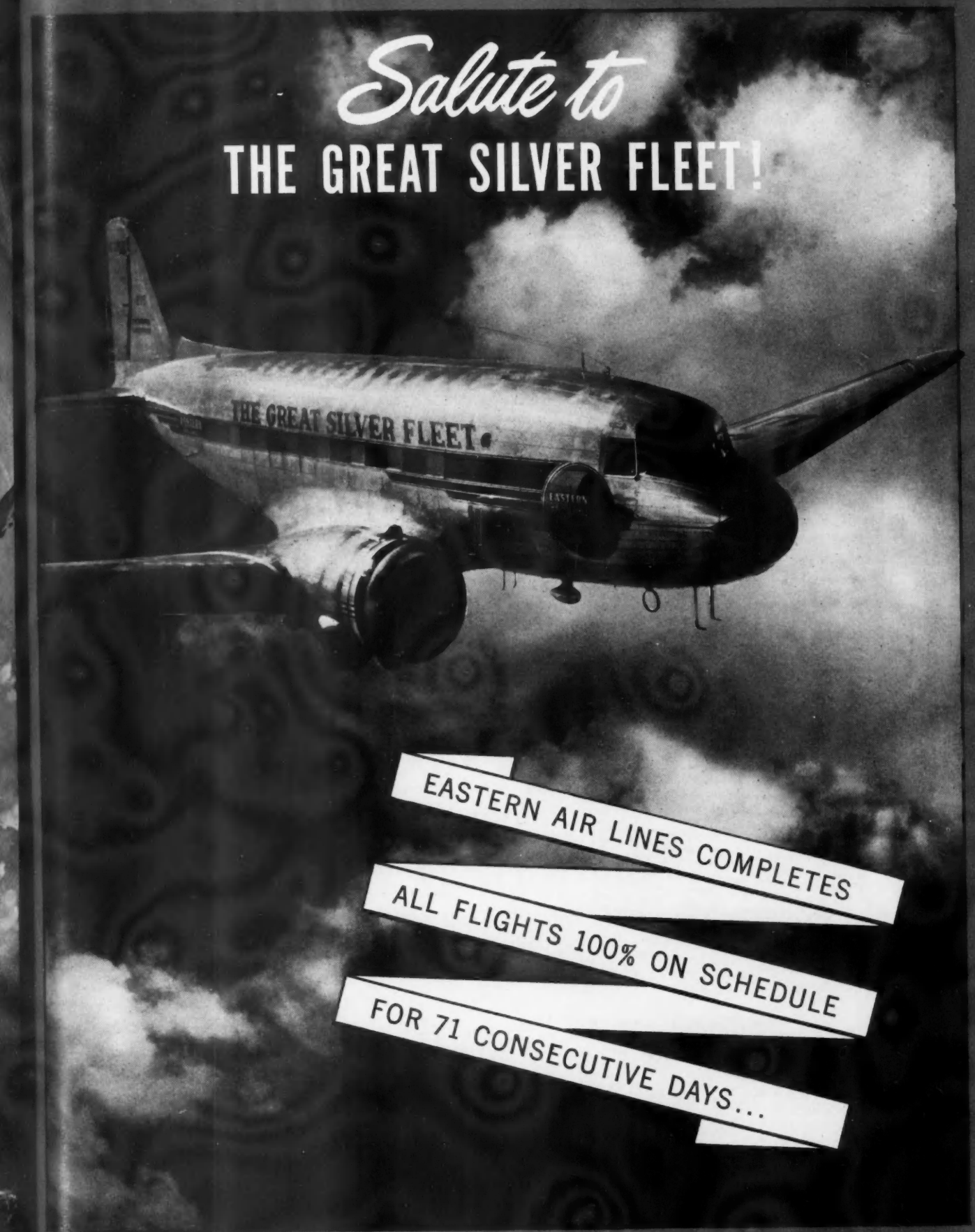
By R. D. Kelly,
Supt. of Development, United Air Lines, Inc.

IN APPROACHING the problem United Air Lines had to consider a device that would function under all air transport operation conditions. It was concluded that a device triggered at a predetermined angle of attack, airspeed, or a single installation of any device would prove inadequate for airline use. A multiplicity of any stall warning device is essential, since the air flow has a tendency to vary under certain conditions and thus changing the stall progression flow accordingly. A multiplicity of any stall warning device over a wing does not mean that the stall progression flow pattern on the wing will

(*Turn to page* 87, *please*)


Excellence of Design
Hoover, the Aristocrat of Bearings, are of the Super-Conrad Deep Groove Type employing the largest size and greatest number of balls. This type of bearing, plus the added advantage of Hoover's exclusive honed raceways has been proved, by actual test, to be the most universally dependable for the varying conditions of load and speed under which modern machines operate.
HOOVER
BALL AND BEARING COMPANY, ANN ARBOR, MICHIGAN

Salute to
THE GREAT SILVER FLEET!



EASTERN AIR LINES COMPLETES
ALL FLIGHTS 100% ON SCHEDULE
FOR 71 CONSECUTIVE DAYS...

UNITED STATES RUBBER COMPANY
1230 Sixth Avenue • Rockefeller Center • New York 20, N. Y.

Eastern writes a new page in Airline History!

New York Times Editorial—August 4, 1944

AIRLINE PERFORMANCE

Spectacular accomplishments by bombers and fighters have brought us some realization of the startlingly swift advances which have been made under the stimulus of war in the range, speed and reliability of aircraft. Combat reports have tended to overshadow, however, the correlative advances which are being made in commercial air transport. The airlines, not only in their function as aids and operators for the armed services in a great network of global flying, but in their domestic operation, have taken great forward strides during the war years. With reduced fleets and personnel, they still have been able to set new marks in passengers, mail and goods carried, and in the performance of schedules. Eastern Airlines, for example, has just established a record not heretofore equaled in commercial air transport history, flying all its schedules with 100 per cent performance for the two consecutive months of June and July. During these months the line's "silver fleet" flew 43,000,000 revenue passenger miles in domestic operations alone, while its cargo liners averaged about 20,000,000-pound miles a day.

This performance and that of the other air carriers, which are showing load factors and percentage of airplane use per day which would have been deemed incredible only a few years ago, indicate the expanded air service for which we may look in the days of peace.

TO TIE OR NOT TO TIE

Never was there a day when it was so vitally important to the nation that high-priority air travel move swiftly to its destination . . . that increased loads of air cargo arrive in plenty and on time.

The achievement of Eastern Air Lines in completing all flights 100% on schedule for 71 consecutive days in the face of capacity loads and with daily flying time of every airplane almost doubled over prewar days is a record that in the words of the New York Times editorial of August 4, 1944, "not heretofore equalled in commercial air transport history."

With a fleet reduced 50%, Eastern has equalled and even exceeded prewar records of passengers and cargoes delivered. With each Silverliner in the air an average of 14 hours and 7 minutes every day, Eastern Air Lines maintenance men are doing a greater, more important job than ever.

As a part of Eastern's regular maintenance plan, every part of the plane is checked, double-checked and triple-checked from propeller to tail wheel tire. The results of this program have made possible a great page in airline history, the forerunner of even greater pages ahead.

1230 SIXTH AVENUE **UNITED STATES**

AND THEY DID THIS JOB BY

Check, Double Check...and Triple Check

Courtesy of Curtiss-Wright

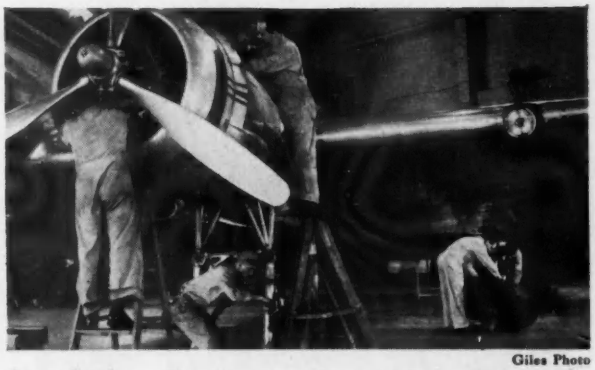
Station Control Board for Maintenance . . . Upon this board is recorded every maintenance service that must be performed by the ground crew before a plane can be cleared for its next flight.

Giles Photo

Station Check . . . At the end of every trip, Eastern Air Lines ground crews check engines, engine and flying instruments, radio equipment, controls, propellers, tires and brakes.

Courtesy of Curtiss-Wright

Terminal Check . . . The basic station check is repeated plus inspection of electrical, ventilation and air conditioning systems, gasoline and oil strainers and valves. Plane and upholstery are cleaned.

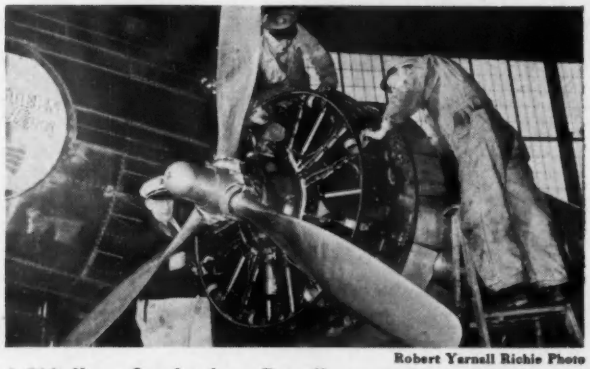


Giles Photo

Base Check . . . This is a complete check-up of the entire plane. Engines, propellers, radio controls, landing gear are inspected with special attention to condition of wheels, brakes and tires.

Giles Photo

650 Hour Check . . . Wheel assemblies are now removed for overhaul. This includes demounting the tire for complete inspection of both tire and tube. Special attention is also given bearings and brakes.



Robert Yarnall Richie Photo

6,500 Hour Overhaul . . . Propellers, engines, electric and radio equipment, lubricating systems, wheels, brakes, tires and all accessories are disassembled and carefully checked before return to service.

RUBBER COMPANY ROCKEFELLER CENTER · NEW YORK 20, N. Y.

SAFETY FIRST, LAST AND ALWAYS

IS EASTERN AIR LINES' CREED

National Safety Council
Incorporated
Founded 1912
"A National Organization Devoted to Securing Increased Safety to Human Life"
Certificate of Special Commendation
Awarded to
Eastern Air Lines
in recognition of its outstanding record in
Safe Air Transportation
Never having had a passenger fatality during its entire operating history, 1930-1936 with an accumulation of 141,194,894 Passenger Miles
This, according to the U.S. Department of Commerce records is the best Air Transport accomplishment to date.
New York, April 14, 1937.
NATIONAL SAFETY COUNCIL
INCORPORATED
Founded 1912
"A National Organization Devoted to Securing Increased Safety to Human Life"
AVIATION SAFETY AWARD
TO
EASTERN AIR LINES, INC.
in recognition of its contribution to Safe Air Transportation, having operated as of December 31, 1943,
635,000,245 Passenger Miles
without a passenger or crew fatality

FIRST SAFETY AWARD—In 1937 the National Safety Council instituted the Aviation Safety Award for Safe Air Transportation. On its record of no passenger fatalities in its entire operating history (1930-1936) Eastern Air Lines won this award. The certificate states, "This, according to U. S. Department of Commerce records is the best Air Transportation Accomplishment to date."

LATEST SAFETY AWARD—Other awards followed and again in 1944 Eastern Air Lines won the National Safety Council Award for commercial air lines operating 100,000,000 passenger miles or more annually. Their record for safe air transportation for the period ending December 31, 1943 totaled 635,000,245 passenger miles without a passenger or crew fatality.

U. S. ROYALS

ARE SAFETY-TESTED, TOO

By test on Eastern Silverliners, in service on landing fields and carrier decks wherever airplanes fly, U. S. Royal Airplane tires have proved their stamina. They are contributing their part in making landings and take-offs safer under heavier loads and tougher operating schedules.

To give the extra strength, extra safety needed to do this wartime job, "U. S." pioneered lighter, stronger rayon and nylon cord constructions now used throughout our Armed Forces. On the air routes of the world, on airliners, bombers, fighters and giant transports, U. S. Royal Airplane tires are setting new safety records day by day.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

SERVING THROUGH SCIENCE TO SPEED THE VICTORY

UNITED STATES RUBBER COMPANY

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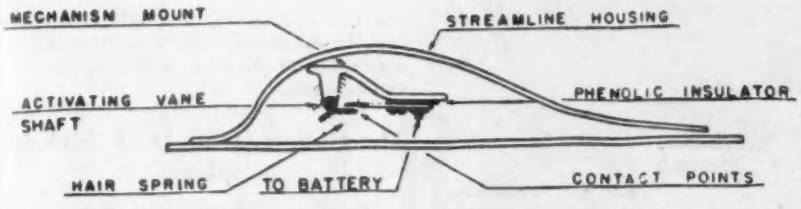


Fig. 9. Cross section of vane type switch

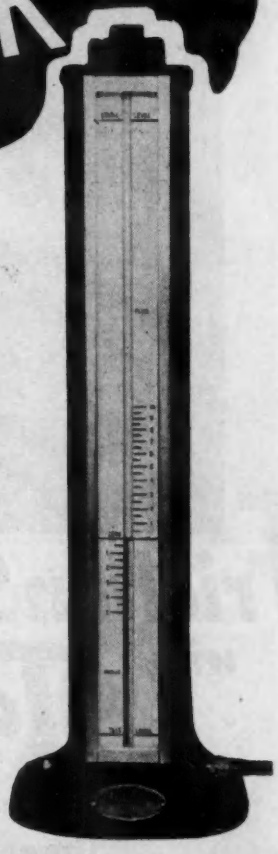
always appear on the instrument panel in the same sequence. But the pilot will know that, immediately upon the glowing of any one light, there is an impending stall danger and corrective measures must be taken.

The development program to date has considered various types of airflow sensitive switches or units suitable for location on the aft portion of the low pressure surface (upper side of the main wing) of the airfoil. These units have utilized vanes, tuft springs, impact pressure tubes and suction producing openings as possible means for detecting the incipient breakdown of smooth air flow over airfoil surfaces. The principal flight test work has been carried out using the vane type of unit shown on Fig. 9. Other types of modifications of wing switches may prove preferable for airline service, due to exposure of the sensitive vane to damage by washing, fuel hoses, wing covers, and the like. For most of the flight tests 10 wing switches, electrically connected to a similar number of lights in an instrument panel, were employed on one wing. It is believed that so many switches are not necessary for service installations. Tests disclosed a stall warning system can be provided by this means that will give the pilot approximately an 18-mph margin, above the actual stalling speed of the aircraft, when the first light flashes, regardless of the flight condition. The increase in stall speed during a banked turn due to the increased acceleration of the turn is properly accounted for by the United Air Lines' system, which also is effective in providing a margin of warning an approaching stall condition under icing conditions and during tight turns when there is an increase of stalling speed. It will show when there is a smooth airflow over the wing and sufficient speed has been attained for take-off. Other important uses for this system is obtained during approaches for landings or when it is necessary to keep the airplane at a low speed for structural reasons.

Another form of wing switch which has been tried by United Air Lines is the suction type switch shown in Fig. 10. It operates on the change in pressure differential induced by the change in localized airflow characteristics. Several variations have been tried and fair duplication of the action of the vane type units has been achieved. The differential pressure operated switch offers the advantage of less likelihood of damage in service by wing covers, gasoline hoses, washing, etc. Further tests of this type of switch are currently in progress.

Each wing unit is mounted on a handhole cover. Submerged within the wing is a suction operated diaphragm which controls an electrical switch. The suction is created by a streamline housing mounted on top of the handhole cover. Due to the airflow shape of the housing, smooth airflow on the wing causes an area of low pressure to form on top of the housing, and a slot is cut in the housing to transmit this reduced pressure to the diaphragm. As the airplane approaches a stall, the airflow over the wing becomes turbulent, reduc-

The METRICATOR



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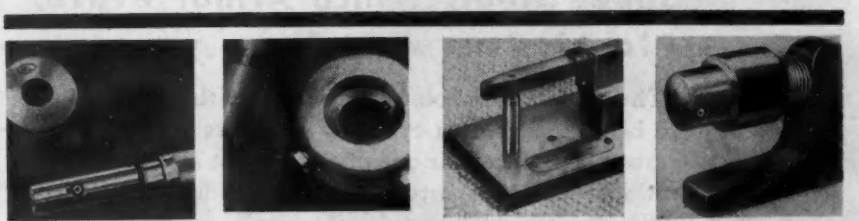

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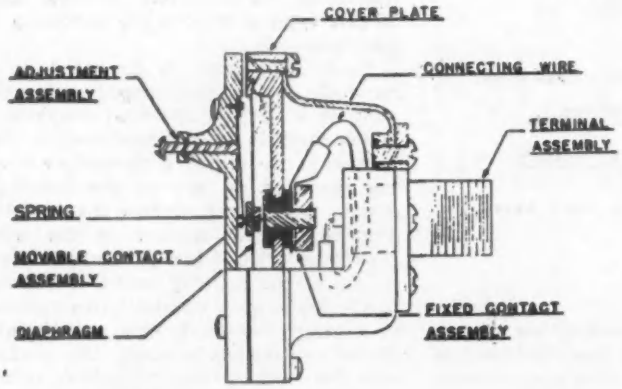


Fig. 10. Cross section of suction type switch

ing the suction on the unit and allowing the diaphragm to close its electrical contact and flash a warning light in the cockpit.

The Design of the DC-4/C-54 Airplane

By **E. F. Burton**, Chief Engineer, and **Carlos Wood**, Chief of Preliminary Design Section, Santa Monica Plant, Douglas Aircraft Co., Inc.

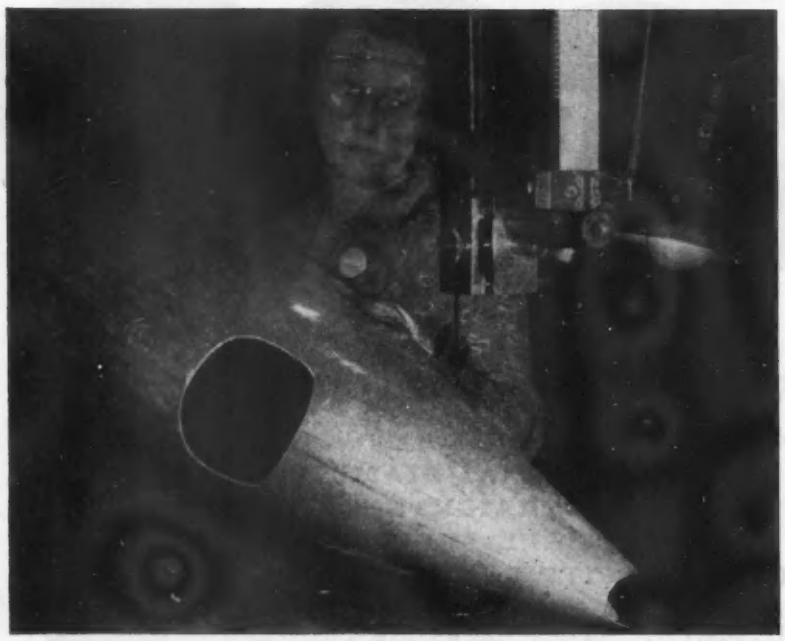
WITH the approach of the war it became advisable to make use of airplanes already designed and under construction if possible and accordingly the DC-4 contracts were taken over by the military authority and the airplane was rechristened the C-54. The C-54, as originally built, was unsatisfactory for the transport of military materiel because of the light weight floor design and the small loading doors. It also became necessary to raise the allowable operating weights in order to permit greater utility of the plane. Accordingly, certain portions of the structure were redesigned and strengthened for the revised airplane now known as the C-54A. The demand for transportation of ever larger quantities of military personnel and equipment over longer ranges required further changes that were incorporated in the modification known as the C-54B.

First of all, any highly engineered article must have a definite design basis. To make sure all items in the aircraft work properly and will allow high utility in operation, it is essential that the basic design of the aircraft be properly organized. In many cases, two or more items will have an intense desire to be in the same spot. As a result, it is necessary to establish general priorities for design items. First priority mut be given to safety items, as safe delivery and dependability in operation are essential. Safe flying and stalling characteristics are essential. Good landing, take-off and ground handling characteristics are also very desirable.

Second priority must be given to utility items. Ease of loading either cargo or personnel is desirable, but for utmost utilty in a long range transport load carrying ability is of highest importance. A large uninterrupted compartment is desirable. In addition the design must be such that the operating weight is a maximum, while the weight empty is a minimum.

Airplanes of relatively large size, such as the DC-4, the third priority must be given to the flight control system. Care must be taken to keep the level of control forces low, and to eliminate all possible friction from the system if good flying characteristics are to be obtained.

Fourth in order are probably power plant and fuel systems. Under circumstances that govern the design of an airplane such as this one, primary structure is of about fifth priority due to the fact that it must often make way for safety, utility, control and power plant items. (*Page*, 90, *please*)



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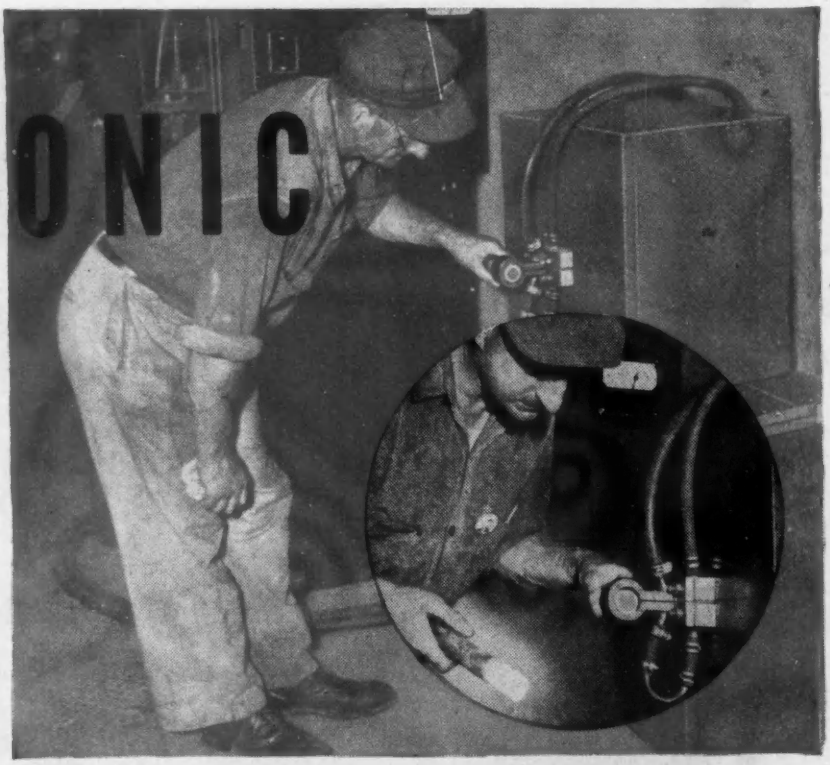

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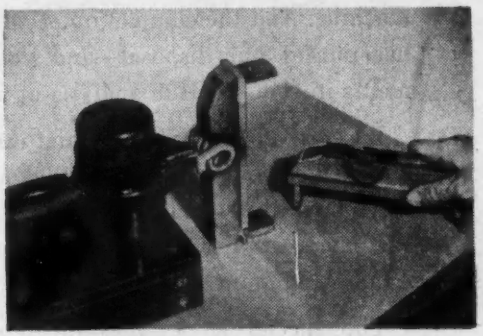

A 20-kw. Ajax-Northrup tube converter provides power for hardening sprocket teeth above. Below, 6-kw. spark-gap set hardens ordnance part in 35 seconds.

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Thus we have the basic considerations that govern the design of an airplane such as the DC-4. Due consideration has indicated that military cargo airplaes such as those of the C-54 series are capable of being designed to the same fundamental requirements.

Metallurgical Control of Aircraft Forgings

By A. J. Pepin, Chief Metallurgist, Eastern Div., Wyman-Gordon Co.

OF THE various developments in the aircraft forging field, one of the most interesting is the forging of one-piece propeller hubs with semi-pierced arms. This development is important, not only because of the tremendous saving in raw material and consequently in machining time, but also because it results in a metallurgically improved product. Previous to the war, all one-piece propeller hubs were furnished as a solid forging. With the increased production brought on by the war and with the help and encouragement of the Aeroproducts Division of General Motors, Wyman-Gordon designed a method and equipment for furnishing these forgings with semi-pierced arms. Improved grain flow resulted and the saving in material depending on the size of the hub amounts from 75 to 125 lb per forging. The equipment used for the operation is a large hydraulic press of special design. The various steps in the forging procedure follow:

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With the greatly reduced volume after the war, it will become a question in many instances whether the use of an alloy steel forging can be justified because of the high cost, brought about by the small number of pieces required. In this connection a great deal can be

(*Turn to page* 94, *please*)

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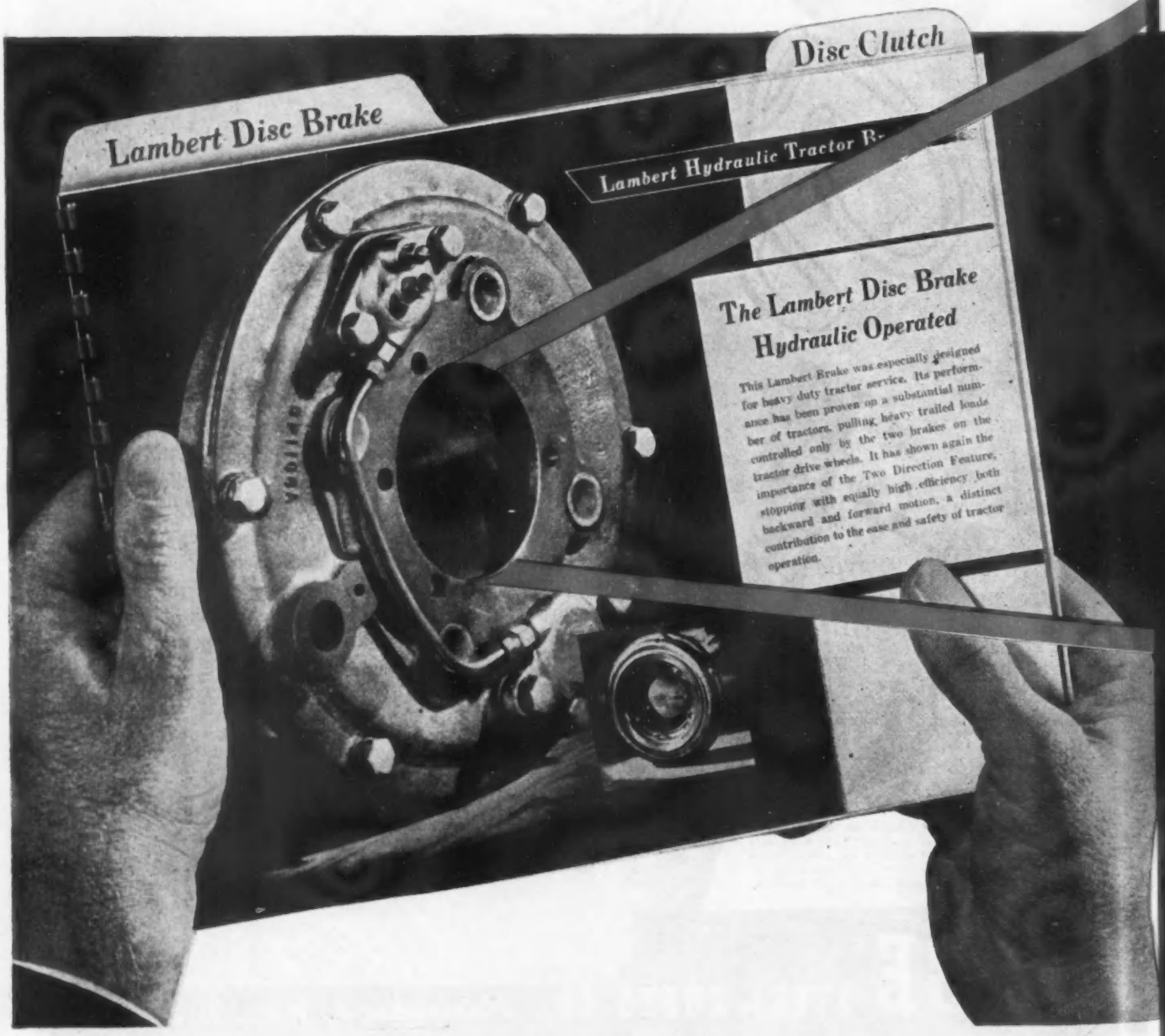
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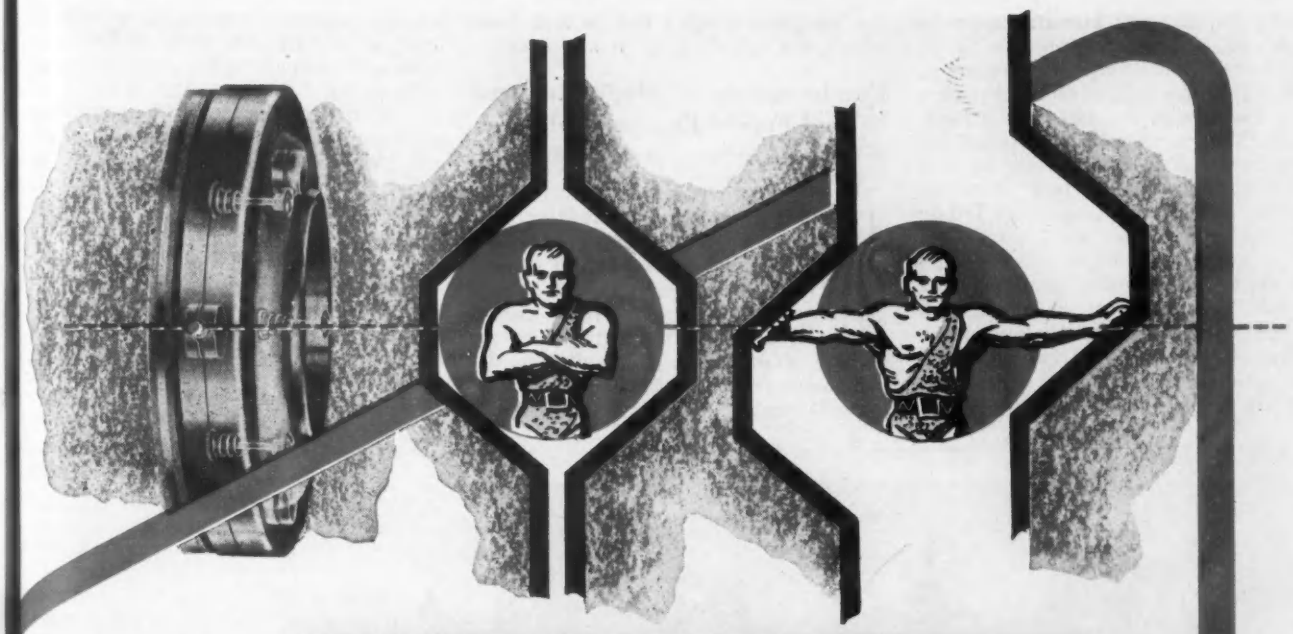

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done by the aircraft manufacturers in the design of their forgings to facilitate more economical production of small quantities. Frequently by very minor changes in the design of a forging, such as increased tolerances, increased radii and draft angles, the cost of forging dies required to produce the part can be reduced as much as 1/3 or ½. This reduced cost when applied to a small quantity of 50 or 100 forgings amounts to a substantial sum per piece and can, in many cases, be offset by a few cents additional machining on the forging. There are, of course, some cases where changes such as increased radii are undesirable and for that reason no general rules can be laid down which are satisfactory in all cases.

Fundamentals of Flight-Induced and Forced Engine Cooling

By J. H. Brewster, III, Senior Aeronautical Engineer, Research Div., United Aircraft Corp.

THEORETICALLY, any installation (air cooled or liquid cooled) can benefit by forced cooling, if the forced cooling device is as efficient as the airplane propeller. Actually, the need for forced cooling is inversely proportional to the degree of engine and installation development from the standpoint of cooling efficiency. Practically, the liquid-cooled radiator, because of its efficient cooling surface, has reached the point where the improvement in performance offered by forced cooling is not sufficient to offset the added complexity and weight. The air cooled engine has not yet reached the point of development where practical performance gains are always offset by the added weight and complexity of forced cooling. With new improvements in finning and baffling, however, certain air cooled engines are approaching and potentially may exceed the capabilities of liquid cooled radiators. But, it is the installation, as well as the engine, that must be considered.

Reverse Thrust Propellers As Landing Brakes

By Jack H. Sheets, Chief Design Engineer, and Gordon W. MacKinney, Installations Engineer, Propeller Div., Curtiss-Wright Corp.

AS PART of the Army's test program a series of landings using reverse thrust from the propellers has been made on a service airplane equipped with Curtis Electric Propellers, Model C644S-A. The data presented in Table 1 are an average of landing run measurements made on approximately 50 landings made during this test rather than figures from a specific landing since it was found that variations in operating technique and application of wheel brakes as used by the various flight crews made it impractical to complete the tests under identical conditions.

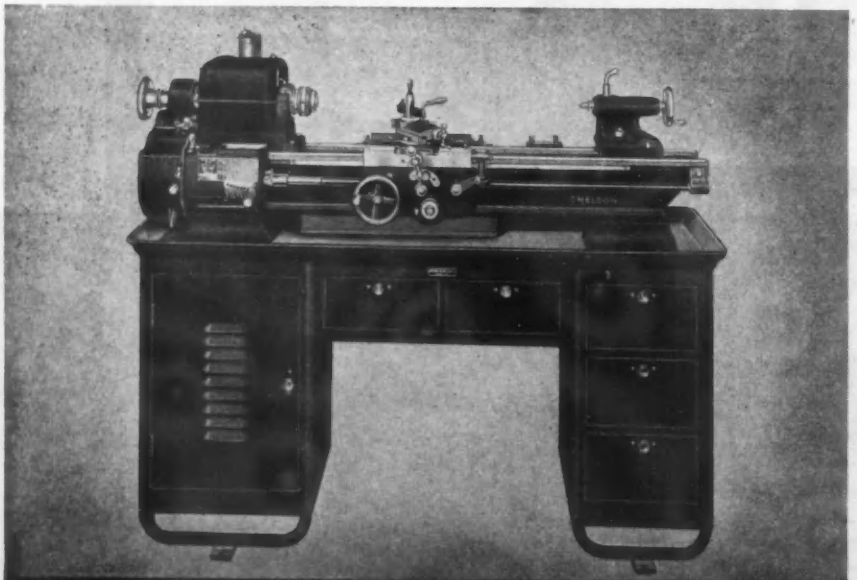
Table 1—Average Landing Run Measurements Obtained During Tests on Service Airplane

Condition	Landing Run—Feet	Per Cent of Brakes Alone Condition
Brakes alone	2700	100
Two propellers reversed, no brakes	2050	76
Four propellers reversed, no brakes	1430	53
Two propellers reversed, with brakes	1400	52
Four propellers reversed, with brakes	1190	44
Emergency locked brakes	1300	48

The landing run with wheel brakes can be considerably reduced with locked brakes as shown during this test when one landing made with locked brakes and no reverse thrust from the propellers resulted in a landing run of approximately 1300 feet. This cannot be considered a normal landing since the tires and tubes for both outboard wheels were worn completely through and the tread of the inboard tires was damaged to such an extent that they had to be replaced also. These tests show that with four propellers reversed and no brakes the landing run was 53 per cent of that with brakes only. When brakes are used together with four propellers reversed a landing distance only 44 per cent of that with brakes alone resulted.

At present, it appears that the reduction of wheel and brake weight, made possible by reversible pitch pro-

(*Turn to page* 154, *please*)



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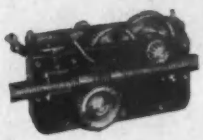

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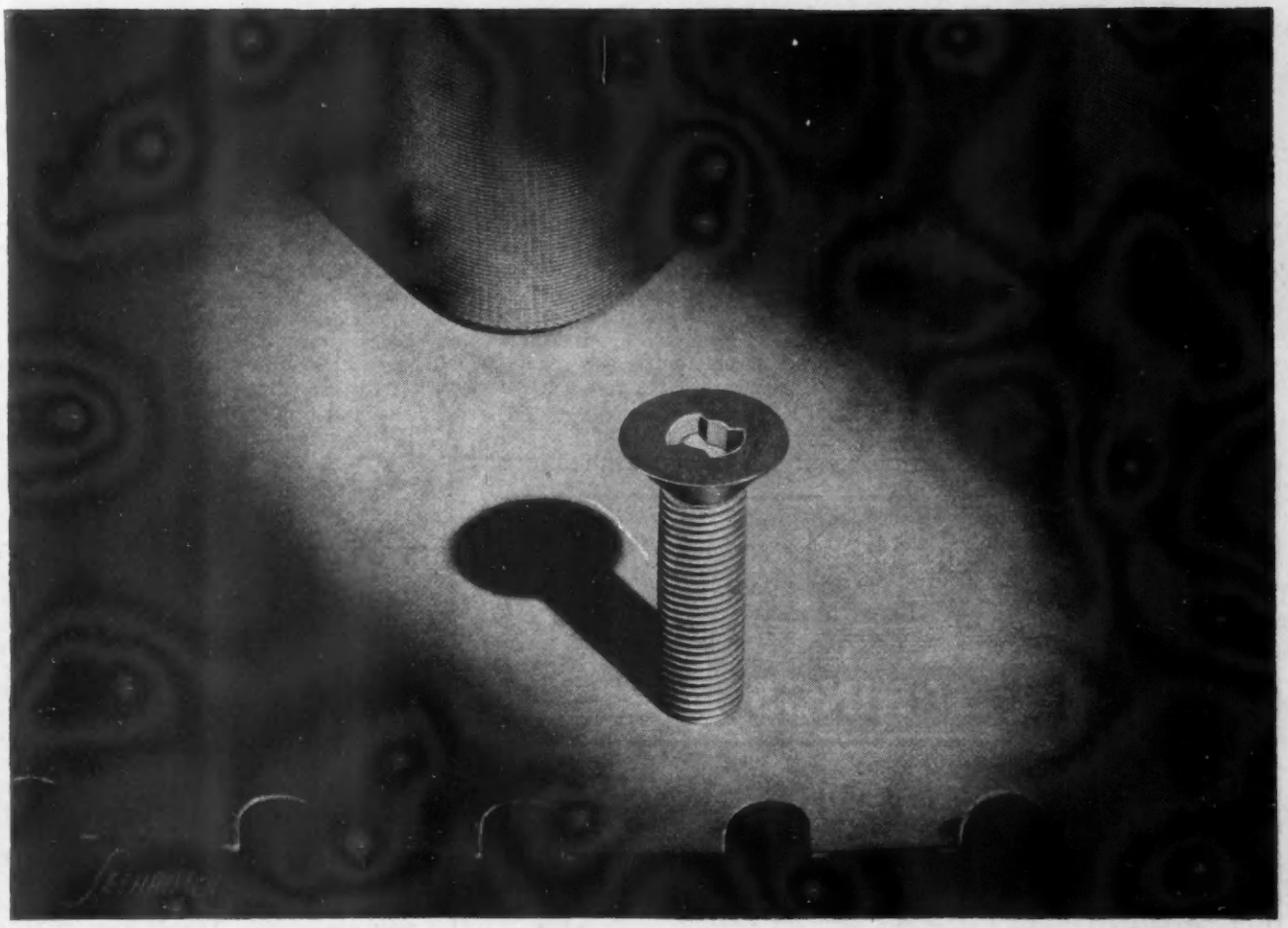

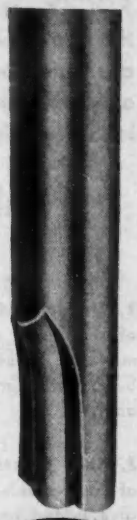

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What Happened in France

(*Continued from page* 18)

"Since the Armistice, all internal combustion and electric vehicles in occupied France are requisitioned at the factories by the German army. However, the C.O.A. has secured a certain contingent of vehicles for civilian use. These vehicles are obtained by means of purchasing permits approved by the German authorities. In addition, the orders department will unite the orders which the German army and the German private industry wishes to place with the French motor industry."

Despite these efforts, production decreased until in the spring of 1944 the industrial life of France had practically ceased to exist. This must be attributed to the bombing by American and British air forces, to the blockade, and to sabotage. Owing to the shortage of current, all factories had to close two days a week from December, 1943. As a matter of fact many of the factories did not work more than two days a week. It is estimated that at this period production in the factories in operation was 50 per cent below normal, this being due to shortage of electricity and raw materials and to go-slow methods adopted by the workers. As an example, Citroen, with 11,000 hands, was producing only 16 trucks a day. Early May all factories in the Paris district were closed for a week owing to the shortage of current. Town gas for trucks was cut 25 per cent and the domestic allowance of gas and electricity was reduced almost to the vanishing point. In the Paris district the total allowance of current for industrial purposes was one million kilowatts per week. In normal times Renault alone used 1,200,000 kw.

Citroen shut down on May 12 and Renault a day later. The French Fiat Company closed at the same time and the workers set to clean up the wreckage caused by the bombing of La Chapelle railroad depot. Many of the factories were called upon to work at night, because of the shortage of current. At this time the Peugeot hands went on strike against night work. As a general rule there was no production after the end of the first week of May, 1944, and if work has not been taken up since it is because the shortage of electricity is more acute now than when the Germans were here. During May the Citroen hands were sent to clean up the wreckage on the railway line at Juvisy, which had been very heavily bombed by the R.A.F. It was well known that the men did little work and a lot of pillaging.

The shortage of raw materials was felt very early. The shortage of rubber was particularly acute. As early as 1940 it was officially stated "Rubber is at the base of all motor production programs, but at the present time rubber is the rarest of all raw materials necessary for the production of automobiles." Normally, France should have received 75,000 tons of raw crude rubber in 1941. She received none.

By 1942 all the tire factories had been switched over to synthetic rubber supplied by Germany. Bombing of the tire factories did not begin until much later. There were two attacks on the Goodrich factory at Colombes, near Paris. In the second attack the place was wiped out, without the loss of life. The Gnome & Rhone factory close by was attacked at the same time, but here more than 600 people were killed owing to the absence of shelters and an order to the effect that the hands should scatter in the fields. When the Dunlop tire factory at Montlucon was brought down, four workers only were killed. The old Michelin factory could not be attacked, because it was in the heart of Clermont-Ferrand. The new factory, however, on the outskirts of the city was successfully bombed. Practically the only tire factory in France which escaped bombing was Vigor, belonging to Louis Renault. This was not hit, although the main automobile factory was very considerably destroyed as the result of four attacks.

Fuel shortage was acute from the

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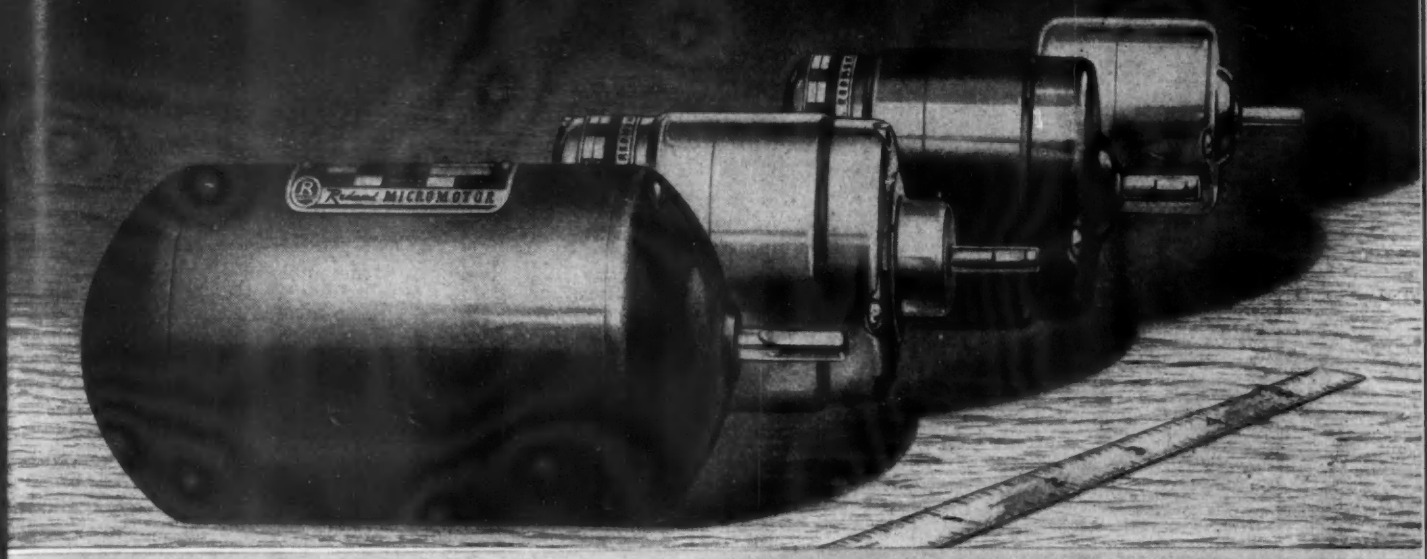
ADAPTABLE



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Products being treated in E F Chain Belt Furnaces, include:

Sprockets
Cap screws
Bolts and nuts
Gears and pinions
Flat springs
Coil springs
Small forgings
Valve springs
Spring plates
Tractor links
Rivets and washers
Wrench & tool parts
Bearing parts
—cups and cones
Machine gun
cartridge clips
Aircraft engine parts
Automotive parts
Rock bits, and many other products

For Hardening Small Parts

175 to 2000 lbs. per hour

Uniformly — Scale-Free — Continuously

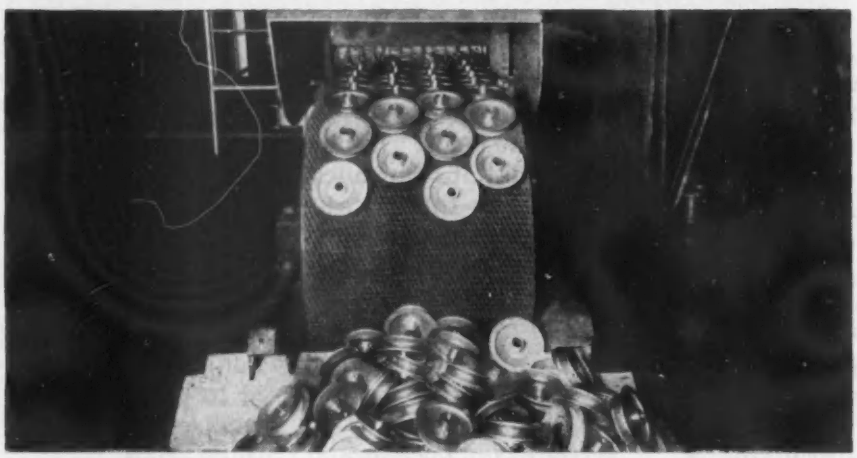
The above gas fired radiant tube chain belt furnace is one of three we installed in one plant. Hundreds are in operation handling products such as listed at left. We build them for gas, oil or electrically heated.

The EF chain belt conveyor type furnace is one of the most satisfactory general purpose furnaces built for the continuous, uniform, economical production heat treatment of small and medium size products. We will be glad to send complete data on these and other types we build.

Send for circulars showing the chain belt and other types of EF production furnaces

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production



The Completed Assemblies are Discharged

Securely Joined, Bright, Continuously

. . . from EF Brazing Furnaces

Products difficult or expensive to make in one piece can be made in several pieces and joined. Products requiring several stampings joined or requiring screw machine parts, forgings and stampings to complete the unit, can be neatly and economically joined right in your production line.

Strong, leak-proof joints are made and the completed unit is discharged from the furnace—clean and bright. Any number of joints in the same product or any number of pieces can be joined at one time.

Investigate This Process for Joining Your Aluminum, Brass, Copper or Steel Parts.

Send for printed matter showing various types of EF brazing furnaces.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

beginning. All private motoring was abolished as soon as the Germans came into France. The 3000 odd buses which ran in Paris were taken off the streets, and the 15,000 taxicabs which Paris normally employed were all laid up. Diesel trucks ceased to exist because of the shortage of gas oil. A committee was appointed to develop substitute fuels, and although the scientists promised brilliant results, the only fuels which gave any satisfaction were wood and charcoal. In 1943 an official census showed that rather more than 200,000 trucks of all types were in service, and of these 80 per cent were running on wood or charcoal.

There was a strong campaign for the use of alcohol as a national fuel. Experiments were made with injection systems and it was proposed that engines should be specially designed to burn alcohol. The supporters of alcohol fuel, however, ignored the fact that coal would have to be imported for distillation. There was no use of pure alcohol, although in early 1944 the official liquid fuel issued by the Germans was composed of 37 per cent gasoline (synthetic), 33 per cent alcohol and 30 per cent benzol.

Town gas was used to a limited extent, particularly on a few motor buses operating in the industrial suburbs of Paris. The gas was carried in bags made of two layers of cotton united by rubber solution, the capacity being 18 to 20 cubic meters, which gave a radius of action of 10 miles.

An attempt was made to recover metals by calling in all private cars built before 1925. As the law was worded this affected 1925 models built in 1926 and 1927. Breakdown gangs were trained to handle these old cars, but the result was insignificant. Apparently the allowance for breaking up the cars was so small that nobody was interested in doing the work. The fact remains that thousands of cars were left lying rotting in garages and yards because their owners had no means of protecting or maintaining them. At the same time bronze statues were removed in Paris to salvage the metal.

Despite all their powers and all their efforts, automobile production in France decreased as the war advanced. In 1941 the total production of trucks and passenger cars was 56,743, of which 44,385 were for the Germans. In 1942 the total was 44,792, of which 39,380 went to the German army, while in 1943 production had dropped to 20,960 vehicles, of which all but 2198 were for the Germans. The last yearly prewar production figure was 250,000 vehicles. No figures are available for the first six months of 1944, but it is known that production was very low.

Every factory was under the control of a German official, who was invested with full powers. In the case of small factories, one man controlled several. Order No. 55, of Feb. 25, 1942, indicated that by authority of the Fuehrer:

'ROUND TRIP TICKET

These Helldiver pilots take off from their "flat-tops", carrying what amounts to a 'Round Trip Ticket. Like all other Navy planes, Helldivers are equipped with Aircraft Radio Instrument Landing Equipment solely manufactured for the U. S. Navy by

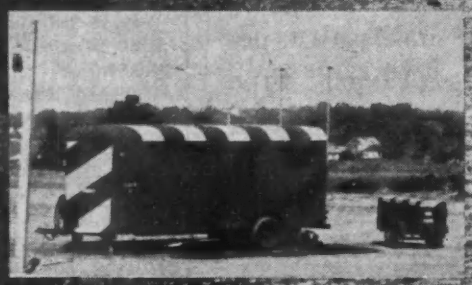
AIR-TRACK MANUFACTURING CORP.

Subsidary of F. L. Jacobs Co.
COLLEGE PARK, MARYLAND

Radio Landing Equipment helps guide safely back to their ship or land bases, pilots flying under most adverse of weather conditions.

In addition to this safety device, Air-Track manufactures Water Radio-Navigation Equipment to help the pilot safely guide his ship under adverse conditions; Beacon Transmitter and Receiver Equipment for *all* our Forces and Radar Test and Trainer Equipment.

Official U. S. Navy Photograph



Shown at the left is a Mobile Trailer used by the Navy on its land bases. It is built and equipped with Aircraft Radio Instrument Landing Equipment made by the worker-fighters of Air-Track ... just awarded their 5th Citation for efficiency and now proudly displaying the Army-Navy "E" flag with FOUR stars.

F. L. JACOBS CO.

Main Plant, 1043 Spruce Street, Detroit 1, Michigan

DIVISIONS

Grand Rapids Metalcraft Division
Grand Rapids, Michigan

Suspension Plant—Lonyo Blvd.
Dearborn, Michigan

Dallas Plant
Detroit, Michigan

SUBSIDIARIES

Air-Track Manufacturing Corp.
College Park, Maryland

Parts Manufacturing Co.
Traverse City, Michigan

Continental Die Casting Corp
Detroit, Michigan

"If the economical situation and particularly the use of raw material made it necessary, establishments could be closed, either completely or partially. The supply of raw material to such establishments is forbidden. Raw material found in such establishments will be confiscated." Thus, if production was not maintained at the level set by the Germans, the owners risked losing everything.

In a certain measure the low production figures are explained by the fact that many factories were switched to other work or to the production of parts for the German war machine.

Conscription of labor began early. First it was an appeal to the younger men to relieve those already in Germany. In reality Germany was only sending back the old, sick and incompetent men in order to get young and skilled labor. In the latter part of 1942 the plan was adopted of picking out men by name for work in Germany. They were asked to sign a contract, but if they refused to sign, a German official signed for them. In an official statement it was declared that Minister of Production Bichelonne would sign for the men if they refused. If the designated men did not come forward, the Gestapo went to the factory and picked out hostages. These might be either boys or old men. They were sent to a fortress and treated with no consideration.

Returned workmen claimed that they were practically slaves—thus giving the lie to the Germans "Work in Joy propaganda." One set of workers stationed near Vienna told me that they were called at 4 a.m., driven in trucks to the factory a considerable distance away, given only coffee (malt) in the morning, a vegetable soup at noon, and another soup at night. Frequently they had to wait until 8 p.m. for their evening meal. Thousands went into hiding, trained young men passed as laborers, or joined the Maquis to avoid conscription.

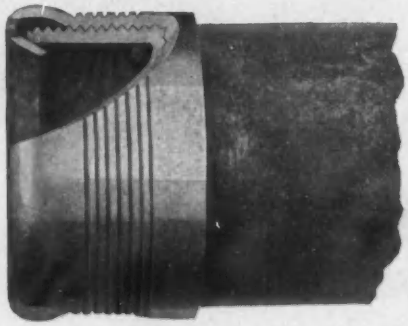
Germany's transport system was impressive in 1940. By 1944 it had been reduced to a mere skeleton, and when the American and British armies came in we realized that the Allies were immeasurably ahead of Germany at the height of her power.

The first sign of transportation difficulties was the radical abolition of private motoring, or even of trucking, followed by the restricted use of cars by officers. Then the Germans began to use charcoal burning trucks, not only for services in the rear, but up the line. It was no uncommon sight to see the latest and most expensive types of American automobiles fitted with charcoal-gas producing plants and placed at the service of generals.

Horses were bought by the thousand. By 1943 large numbers of very rudimentary Russian horse wagons were in service with the German army in France. Civilian trucks were requisitioned on a big scale. During the two months preceding the relief of Paris, the formality of requisitioning was dispensed with, trucks being taken from their owners on the road, and under the threat of a revolver the civilian drivers were made to go up the line with loads of ammunition. Thousands of bicycles were taken in the same way. If the riders did not stop instantly, they were shot.

It is estimated that at the present time France possesses about 500,000 passenger cars and 120,000 trucks. Many of these are in very poor condition. The pre-war estimates were a total of 2,600,000 motor vehicles of all types. When he was at the head of the C.O.A., François Lehideux predicted that the French automobile fleet could be reconstructed in five years. During the first year after the war the program would be 55,000 passenger cars and 85,000 trucks. In the fifth year the figures would be 250,000 passenger cars and 120,000 trucks. These figures should be accepted with a great deal of reserve, however, for at the time they were given Lehideux did not know how the war would end, in what condition the country would find itself, and there was also the fear that Germany would not allow France to possess an automobile industry.

Use WEDGE Split CHILL RINGS to weld pipe joints FASTER and BETTER



Patent No. 2,156,169

Many have found that by using WEDGE Chill Rings with the patented SPLIT Feature they can weld pipe joints FASTER and BETTER. You get STRONGER joints and can use less skilled help. It will pay to investigate.

WEDGE MAKES ALL TYPES OF THREAD Protectors

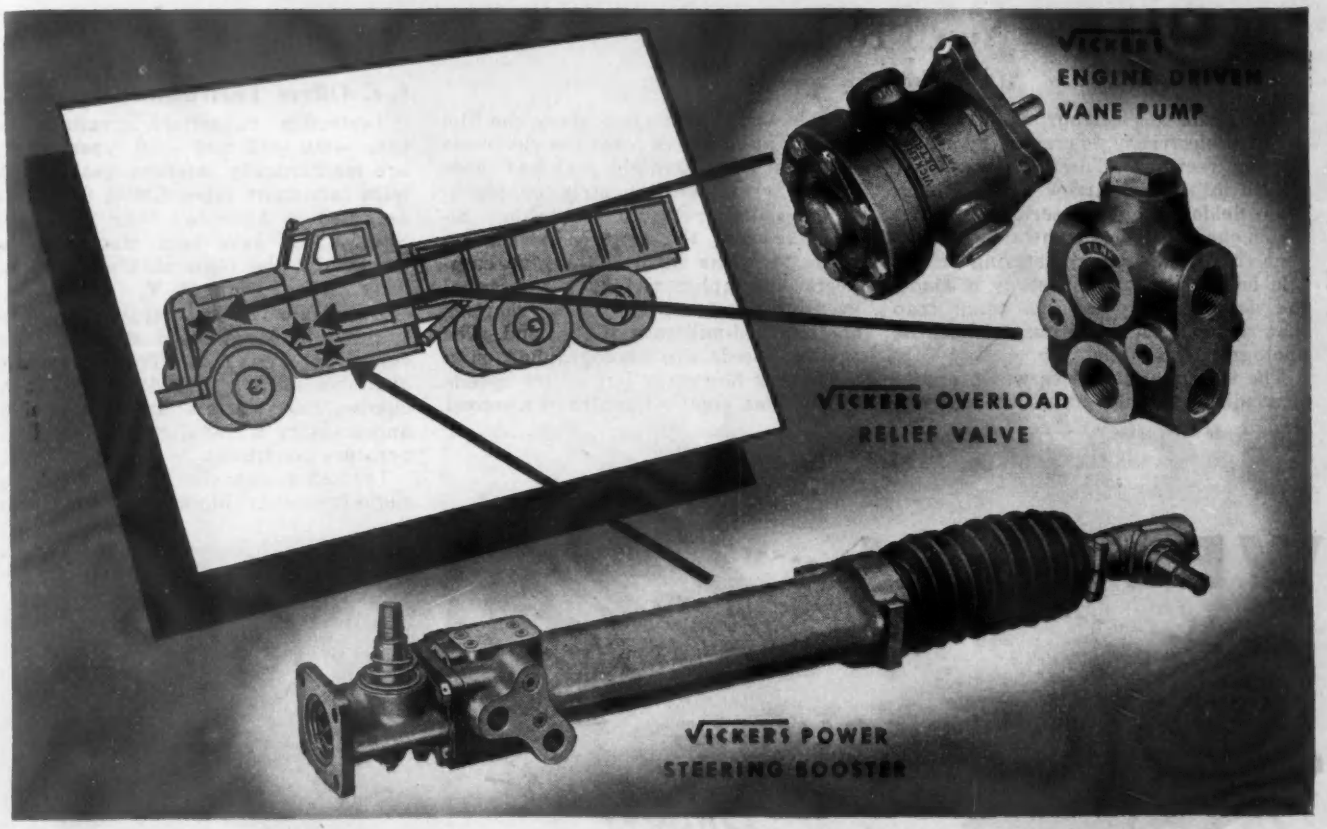
Split Feature Patented

WEDGE specializes in protectors and makes all types of Closing Plugs, Pipe Protectors, Plain Ends and Thread Protectors. Many standard sizes are available. Consult us regarding unusual or difficult protection of finished parts.

WEDGE PROTECTORS, INC.

9540 RICHMOND AVENUE CLEVELAND 5, OHIO

Use WEDGE Chill Rings-Thread Protectors



EASY INSTALLATION . . . Another Feature of

VICKERS HYDRAULIC POWER STEERING

Being compact and requiring a minimum of space for installation, the Vickers Hydraulic Power Steering System can be applied to most existing hand steering mechanisms with a few simple alterations. The separate and compact power cylinder (booster) can be located where it does not interfere with other apparatus and where the power will be applied directly to (and in line with) the drag link. No additional space is required at the end of the steering column where space is usually at a premium.

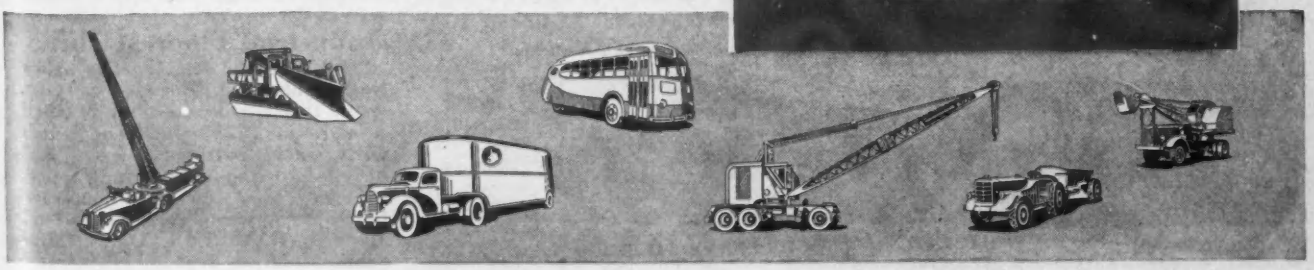
Other important advantages of Vickers Hydraulic Power Steering are: effortless, positive and shockless steering, automatic overload protection, reduced operator fatigue, greater road safety, automatic lubrication, and 14 years of operating experience. Bulletin 44-30 gives complete information about Vickers Hydraulic Power Steering; write for a copy.

VICKERS *Incorporated*

1428 OAKMAN BLVD. · DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CINCINNATI • CLEVELAND • DETROIT
LOS ANGELES • NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD
TULSA • WORCESTER

Representative Applications of
VICKERS HYDRAULIC
POWER STEERING



New Products

(*Continued from page* 46)

The beam of electrons, negative particles of electricity, is created by a high voltage rectifier. These electrons are guided into their narrow path by magnetic fields and by a series of plates which channel them downward. To prevent the beam from registering on the film before the ignition study is made, the device incorporates a beam trap that deflects the electrons out of the photographic channel.

The electrical impulses which are to be studied are shot across the path of the electronic beam just above the film rack. The impulses force the electronic beam out of its straight path and cause it to "write" on the strip of photographic film a record of the voltage. Simultaneously, the electron pencil records the time involved to give engineers a graphic record of electrical events that occur in periods as short as one hundred-millionth of a second. The fastest speeds are photographed on a stationary film strip, but slower speeds of less than eight millionths of a second are recorded on a revolving drum that turns 7000 times a minute.

WESTERN Felt

IS SOLVING

These Problems—

HOW TO:

- Exclude Dirt, Grit and Dust
- Retain Lubricants
- Cushion Shock
- Insulate Electrically, and Against Heat and Sound
- Reduce Weight
- Isolate Vibrations
- Properly Feed and Wick Oil

AND MANY OTHERS

Felt's versatility is of great value in the solution of problems like the above. It is resilient, flexible, compressible; resistant to heat, age, alcohol, etc., and is produced by Western Felt Works in grades ranging from rock hardness to wool softness.

Widely employed as gaskets, channels, washers, padding, wicks and seals, new uses for felt are being discovered daily by Western Felt Works engineers.

If you have any problem involving the possible use of felt, feel free to call on Western Felt Works engineers at any time.

Acadia Synthetic Division
WESTERN FELT WORKS
Processors Synthetic Rubber, Sheets, Extrusions, Molded Parts

WESTERN FELT WORKS
4035-4117 Ogden Ave., Chicago 23, Illinois
Branch Offices in All Principal Cities

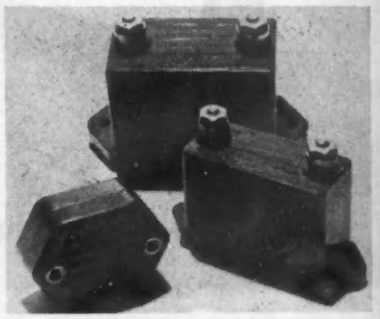
WESTERN Felt
Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felts

G-E Offers Lectrofilm Capacitors

Lectrofilm capacitors, available in case —60, —65 and —70 types, which are mechanically interchangeable with mica capacitors types CM60, 65 and 70 as listed in American War Standards Spec. C75.3, have been placed on the market by the General Electric Company, Schenectady, N. Y.

Lectrofilm is a new synthetic dielectric material developed especially for capacitors and made from materials available in the United States. It is characterized by its uniform quality and stability under high ambient temperature conditions.

Lectrofilm capacitors are suited for radio-frequency blocking and by-pass applications in communications and other electronic equipment. The internal foil and lectrofilm assemblies are arranged for minimum inductance and low foil losses.



G-E Lectrofilm capacitors

These new lectrofilm capacitors are supplied in green, low-loss plastic cases which guard the interior assembly against moisture.

Industrial Floor Machine

This machine for cleaning heavy traffic industrial floors has a 16-in. drum type steel wire brush which revolves at 1725 rpm. The brush hurls metal cuttings, grease, and heavy dirt into a built-in hopper, while an 11-in. direct motor drive fan sucks lighter dust into the bag. Made by G. H. Tennant Co., Minneapolis, Minn.

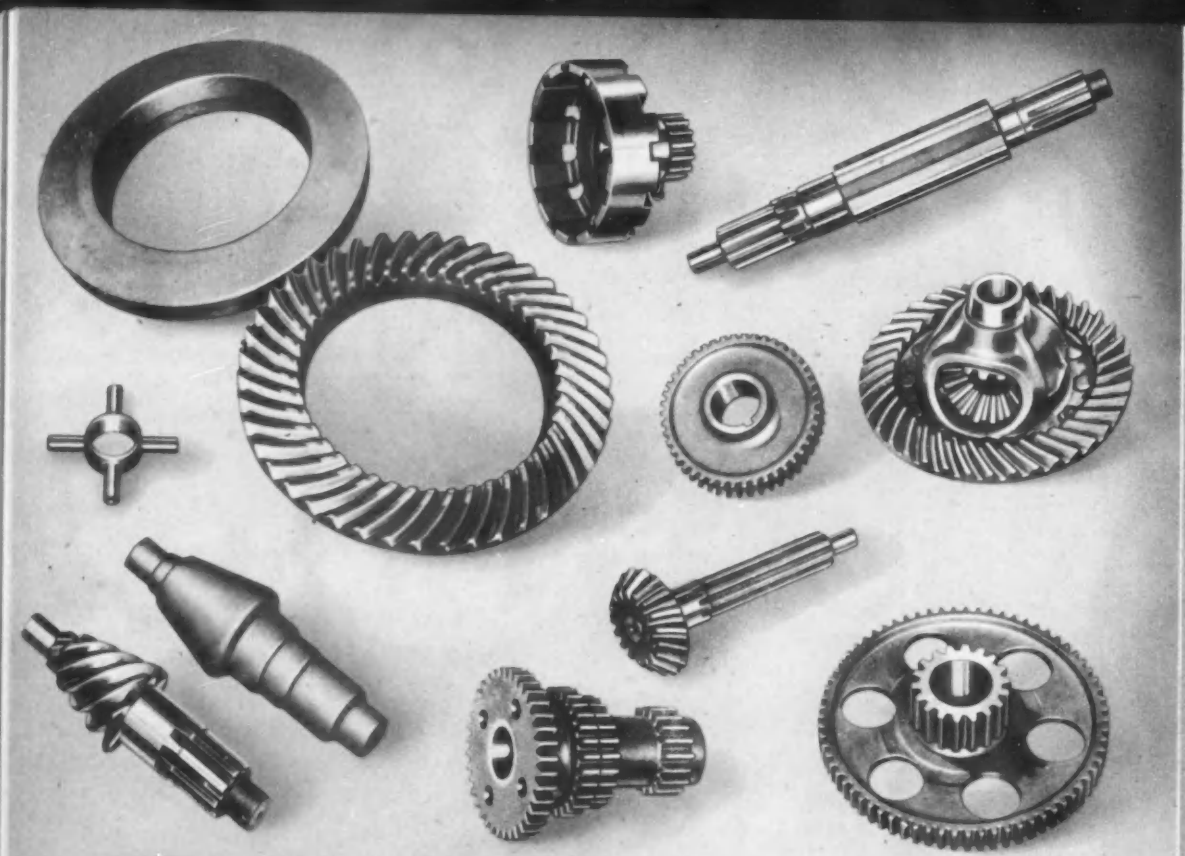
FROST GEARS *and* FORGINGS

MADE TO DO A BETTER JOB

AN EXCEPTIONAL ENGINEERING BACKGROUND BASED ON LONG AND INTIMATE KNOWLEDGE OF VARIED PRODUCT USES... AXLES, TRANSMISSIONS, CAR TRUCKS, INDUSTRIAL TRACTORS, AND KINDRED USES . . . FORGINGS FROM UPSETTERS AND DROP-HAMMERS... CONTINUOUS PRECISE METALLURGICAL CONTROL MEANS FINE QUALITY THAT DOES NOT VARY.

Another PRODUCT of CLARK EQUIPMENT COMPANY

TURN PAGE FOR MORE DATA



STRONGER, MORE DURABLE "SHOCK TROOPS"

These are the "shock troops" of machinery and equipment—Forgings: the "working" parts, stationed at the strategic posts of greatest shock and strain.

It is one thing to possess good equipment and skilled craftsmen for producing good forgings. It is quite another and vitally important thing to command Clark's rich and varied engineering experience, to draw upon Clark's long first-hand understanding of operating problems in many branches of revenue transportation. As builders of commercial axles and transmissions of industrial tractors and railway trucks, Clark's own rigid standards of perfection are your soundest guarantee of satisfaction.

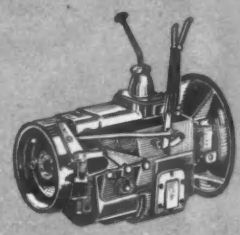
For stronger, more durable "shock troops"—Frost Gears and Forgings; with their plus-value of Clark engineering counsel—yours to command at no cost.

CLARK EQUIPMENT COMPANY
JACKSON, MICHIGAN
Also BATTLE CREEK...BUCHANAN...BERRIEN SPRINGS, MICH.

Another PRODUCT of CLARK EQUIPMENT COMPANY

FROST GEARS and FORGINGS

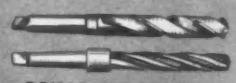
Some CLARK products

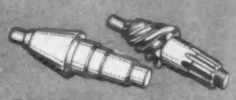

TRANSMISSIONS

BLIND RIVETING PROCESS

AXLE HOUSINGS

FRONT AND REAR AXLES FOR TRUCKS AND BUSSES

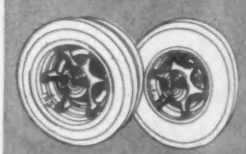

DRILLS AND REAMERS


GEARS AND FORGINGS

ELECTRIC STEEL CASTINGS

INDUSTRIAL TRUCKS AND TRACTORS

RAILWAY CAR TRUCKS


METAL SPOKE WHEELS

Fatigue Strength of Gears

(*Continued from page* 35)

sures were applied to the already finished but unused gears:

1. Chamfer at the shoulder of the tooth increased.
2. Thickness of the rim altered.
3. Grooves caused by grinding and polishing in the tooth gullet removed, the marks of the final machining running at right angles to the teeth.

The results of these measures are shown in the upper Wöhler curve (B) in Fig. 2. It will be seen that the endurance bending force at which, after one million load cycles, no tooth fracture occurred in the unused gear of the original series could be raised from 6500 kg to 17,000 kg. Convincing proof of the benefit of the measures was in the fact that, with one exception, the whole series of improved gears proved to be satisfactory in operation. The exception was a gear to which the special treatment was omitted inadvertently; a tooth fracture occurred during

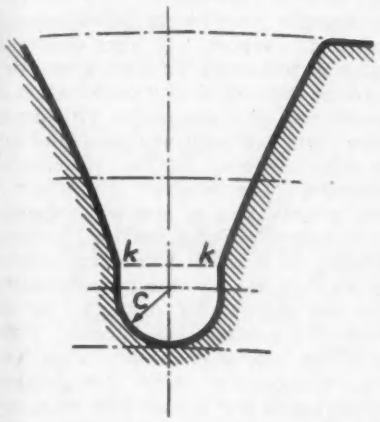


Fig. 4. Tooth profile developed by Daimler-Benz.

flight. The success attending the elimination of the grooves caused by grinding as well as the polishing of the tooth gullet at right angles to the teeth resulted in this treatment being adopted in current practice.

During a subsequent series of tests an experimental gear produced the dot-dash curve (C_1) in Fig. 3, but fractured at a load of 13,000 kg, though at 12,000 kg it withstood over a million load cycles without fracture. Investigation showed that while the tooth gullets had undergone the special machining generally prescribed, the polishing had been omitted. Thereupon, the gullets between a number of teeth of the same gear were polished. A further test was then made; it showed results indicated by the solid curve (C_2) in Fig. 3, i.e. that the polishing alone increased the endurance bending strength from 12,000 to 17,000 kg.

Nevertheless, from time to time gears were found with a maximum resistance below the value expected. Eventually this was proved to be due to cracks in the gullets that had occurred in the grinding of these particular gears.

In addition to the data concerning the position and the course of the cracks, a connection existed between the formation of cracks in the gullet of the tooth and the alteration in the structure. As a rule the local heating which causes the change in the structure is associated with the occurrence of local stresses, which, if sufficiently great, result in the formation of cracks i. e. so-called grinding heat cracks.

Investigations instituted by Daimler-Benz on the strength of these observations, with a view to preventing the occurrence of local stresses or heat cracks, resulted in a considerable lessening if not the complete elimination of the danger of these phenomena. The grinding of the tooth gullet, instead of being carried out in the finished hardened state, is effected in the case-treated state prior to hardening. At the same time the fillet in the gullet of the teeth is extensively rounded and should be semi-circular, as far as possible, not merely to ensure greater

No Vibration in New "Orbital Action" Portable Electric Sander; Relieves Workers' Fatigue

A boon to workers' nerves and health, this new "Orbital Motion" electric sander is actually vibrationless. A great saver of workers' energy as well as man-production hours, the sander can be operated easily in horizontal, vertical or inverted position with one hand. Compared to manual sanding, this machine achieves superior results at least eight times faster. It performs equally well on wood, metal or plastics.

Developed for war industry, this revolutionary new sander has done yeoman duty in this country's manufacturing plants and in allied maintenance and repair depots all over the world.

Wrigley's Spearmint Gum renders a real service to workers too—eases dry throat and relieves tension that brings on fatigue, leaving both hands free to stay on the job. The Army and Navy were quick to appreciate these benefits, that's why they are now shipping to our fighting forces overseas only, our entire limited production of Wrigley's Spearmint. Just as soon as we can supply the home front, too, industry will again enjoy the benefits of Wrigley's Spearmint Gum now proving so important on the battle fronts.

You can get complete information from Sterling Tool Products Company, 155 East Ohio Street, Chicago 11, Illinois

Easily-removed filter cleans air that cools motor—prolongs motor life and reduces maintenance costs.

Dustproof transmission synchronized to eliminate vibration. Oil supply lubricates for 100 operating hours.

Y-160

How WAR-TIME Efforts Improve PEACE-TIME PRODUCTS

Under the imperative demands of war, the processes and products of Industry advance far more swiftly than in times of peace.

For example, Chace research and engineering efforts have produced, for war use, new alloys for Thermostatic Bimetals . . . so quickly responsive that aircraft may soar from temperatures of 130°F. above to 60° below in a matter of minutes—with complete reliance on their thermal controls.

Because of this increased sensitivity, the new alloys also permit the use of smaller actuating elements; and therefore smaller and lighter temperature responsive devices, where space or weight limitations require.

These and other Chace developments may be vitally important to the efficiency of your peace-time products. For among its many types of Thermostatic Bimetals, Chace has one exactly suited to your particular need.

For specific and confidential recommendations, write us detailing your problems.

W. M. CHACE CO.
Manufacturers of
Thermostatic Bimetals and Special Alloys
1610 BEARD AVE • DETROIT 9, MICH.

strength but also to permit the use of a simple method of grinding and polishing the gullet at right angles to the teeth. Fig. 4 shows a tooth profile developed on these lines. During production the gullet of the tooth is machined and polished without grooves in the manner described *after* the case treatment and *before* hardening. The edge K makes a recessing possible when machining the tooth flanks after hardening. A special lapping machine has been developed for finishing the gullet of the tooth.

Marmon Herrington Back to Trucks

(*Continued from page* 31)

bad weather and particularly in winter when the vehicle takes considerable punishment in dirt and mud, it is given a thorough cleaning on wash racks at the entrance end of the building before going into the spray booth.

In common with other manufacturers of military vehicles, M-H has found a sizeable problem in handling spare parts for export. In fact one of the largest buildings on the premises is devoted entirely to the preparation and packaging of spare parts. This department is completely equipped and thoroughly schooled in the standardized procedure for overseas shipping. In the preparation of major components such as engines and clutches, transmissions, etc., it is of interest to note the detail required by Army specifications. On the engine, for example, the bell housing opening, valve cover plates, manifold openings, spark plug holes, etc., are covered with special waterproof paper and coated with wax, making the engine completely sealed. Each of the units is then packed in a separate container, which, in turn, is sealed against the elements.

Final activity is the driveaway. Although M-H has a railroad spur on the premises, driveaway by road is a far better method and results in a major saving of time. The driveaway station is an enclosed area at one end of the property located directly at the highway. For driveaway, one tractor is driven under its own power, while another is mounted on the fifth wheel of the first. For convenience in handling, the front wheels of the towed vehicle are removed, then re-installed at the destination.

The word picture given here is augmented by a group of illustrations taken in various departments of the plant to aid the reader in visualizing interesting areas of activity. Incidentally, what the reader sees here will give a pretty good impression of the facilities that Marmon-Herrington will have to offer when this war ends and when industry is ready to resume its peacetime pursuits.

"Put it on the Blanchard"

...GET THESE ADVANTAGES

Production ✓
Adaptability
Fixture Saving
Operation Saving
Material Saving
Fine Finish
Flatness ✓
Close Limits

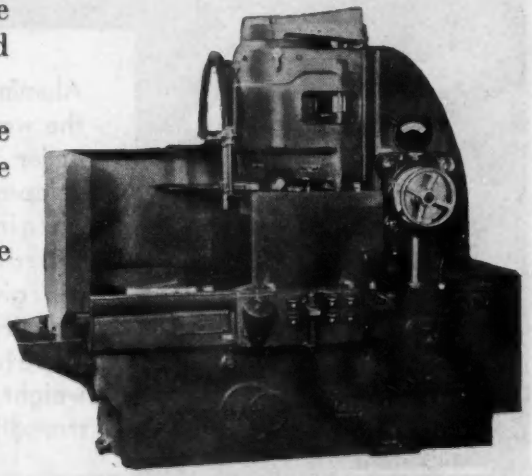
Grinding Cast Iron Rings

Five of these 12" x 1½" cast iron rings are securely held on the 36" magnetic chuck of a No. 18 Blanchard Surface Grinder. Twenty pieces (40 surfaces) per hour are ground flat and parallel, removing 1/64" from each surface.

The illustration shows the narrow surface being ground, the opposite side is a ring of 8" inside diameter and 12" outside diameter and is ground flat within .0005".

For the multiple grinding of parallel surfaces such as these "put it on the Blanchard".

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



No. 18 BLANCHARD SURFACE GRINDER

BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

National Metal Show

(*Continued from page* 44)

pneumatic tools; De-All Co., with a presentation of new contour cutting machines, saws, and precision gages and instruments; The Denison Engineering Co., featuring Hydroilics in equipment for assembling, straightening, broaching, etc.; De Walt Products Corp., with a line of dry and wet type abrasive cutting machinery; Lipe-Rollway Corp., automatic bar feed attachments; Ransome Machinery Co., demonstrating hand and motor operated welding positioners; Spencer Turbine Co., industrial type vacuum cleaners and turbo-compressors; Stow Mfg. Co., power drive flexible shaft machines and equipment; Wells Mfg. Co., wide line of horizontal and vertical metal cutting band saws; Sunnen Products Co., honing machines; Hammond Machinery Builders with cylindrical finishing machines and carbide tool grinders; Porter-Cable Machine Co., with its extensive line of wet belt surfacing machines.

Aluminum Forgings all the way up to 8'6" propeller blade. The development of Aluminum Forgings by Wyman-Gordon for the war will give to post-war industry new production impetus through less weight, plus forging strength.
Wyman-Gordon
WORCESTER
HARVEY, ILLINOIS
Forgings—Laboratory Controlled
MASSACHUSETTS
DETROIT, MICHIGAN

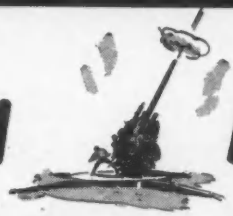
Materials Handling—Among the items of peculiar interest to automotive people were the many exhibits of materials handling equipment of various types, including Alvey-Ferguson conveyor systems—belts, monorail, and roller types; Clark Tructractor Div., Clark Equipment Co., with a line of industrial trucks of various types; Yale & Towne Mfg. Co., Baker Industrial Truck Div., Baker-Raulang Co., and others.

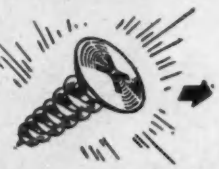
Materials—Showings of materials ran the gamut of useful engineering materials ranging from structural types such as steels, aluminum, magnesium, bronzes, etc., to rare metals, Indium, lead, and radium. Among those present were: the Aluminum Co. of America, Reynolds Metals Co., Acme Aluminum Alloys Co., and Dow Chemical Co., in the light metals field; Jesspo Steel Co., specialists in cast-to-shape steel dies; Carboloy Co., Inc., famed producers of sintered carbides and tools; Vascoloy-Ramet Corp., well-known producers of steel cutting grades of cemented-carbides; Kennametal, Inc., producers of cemented-carbide tools; in the field of alloying materials—International Nickel Co., Climax Molybdenum Co.; special metals and alloys—Carpenter Steel Co., producers of stainless steel for automotive and aircraft products and a wide variety of tool steels and die steels; P. R. Mallory & Co., specialists in rare metals, provided examples of tungsten, silver, and molybdenum contacts, Elkonite and Mallory 3 nonferrous alloys for resistance welding, and the Malloil line of silver bearings; S. K. Wellman featured its special line of powdered metal products including the powdered metal friction linings for brakes and clutches; Indium Corp. of America exhibited ores, concentrates, and finished products, also emphasized the use of Indium as a protective coating on engine bearings; Armstrong Cork Co., with exhibits of insulating fire brick, insulating cements, etc.; American Manganese Steel Div., American Brake Shoe Co., castings exhibit; Ampco Metal, Inc., non-ferrous alloys in sand and centrifugal castings.

Miscellaneous Exhibits—Parker Appliance Co., wide variety of fittings for automotive, aircraft, and marine engine and machinery applications; special fastenings by Elastic Stop Nut Corp., Shakeproof, Inc., Tinnerman Products, Inc.; A. Scharders Son Div., Scovill Mfg. Co., pneumatic controls and pneumatic valves; Precise Products Co., high speed electric hand tools and Coolfle flexible shaft attachments; Metallizing Engineering Co., Inc., metallizing guns for production and salvaging operations; Clinton Machine Co., unique Thomas tap extractor machine for removing broken taps, studs, drills, etc., from work pieces of steel and nonferrous metals.

The use of plaster molds for producing metal castings has been a topic for discussion for many years. At the Congress, the non-ferrous division of

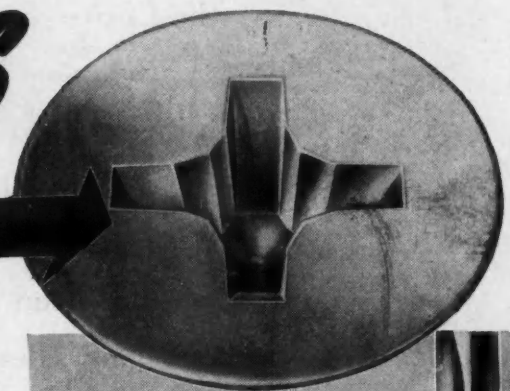
(*Turn to page* 112, *please*)

AS A  WEAPON FOR KNOCKING PRODUCTION COSTS DOWN

IT'S HARD TO MATCH THIS→→ 

THE SCREW WITH THE ENGINEERED RECESS THAT STEPS UP SCREW DRIVING SPEED AS MUCH AS 50%

→→→ IT'S PHILLIPS



THE ENGINEERED RECESS

Right at your command is one of the most potent and efficient weapons for speeding up assembly and cutting costs that you could hope to find.

It's Phillip's – the Engineered Recessed Head for all kinds of screws.

It's the screw recess that eliminates fumbling, wobbly starts, slant driving, and dangerous skids – the troubles that have long made screw driving slow, awkward – and costly!

It's the screw recess that makes driving easier for workers – helps keep them going at top speed through a full shift.

It's the screw recess that lets you adopt spiral and power driving for assemblies where speed tools have never been practical.

Hundreds of plants have increased screw-driving speeds as much as 50% . . . and cut costs correspondingly . . . simply by switching to Phillips Recessed Head Screws. Can you do the same? Make the switch to Phillips Screws now – and you'll see. You'll see they cost *less* because they help you produce much *more!*

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

Faster Starting: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

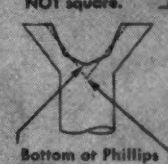
Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Easier Driving: Turning power is fully utilized. Workers maintain speed without tiring.

Better Fastening: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

IDENTIFY IT!

Center corners of Phillips Recess are rounded . . . NOT square.



Bottom of Phillips Recess is nearly flat . . . NOT tapered to a sharp point.

24 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Wolverine Bolt Co., Detroit, Mich.

Mrs. Jones wants to know

How Long it takes to build a Washing Machine

Sometime during the progress of every sale, the matter of price has to be dealt with.

★ Mrs. Jones doesn't know, and doesn't really care, whether your plant produces washing machines in an hour or a month.

But she does know that the more it costs you to build them, the more she has to pay for them.

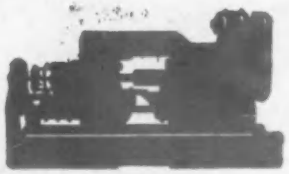
Most people are human enough to want to buy at the best price they can find, for equal quality.

And most merchandisers know that markets for anything tend to broaden when prices are reduced.

Acme-Gridley Automatics—Bar and Chucking Types—make a vital contribution to the price question by turning out precision metal parts faster, hence at lower cost.

Sound sales strategy, in your business or any business, suggests that any method or machine that cuts production costs, therefore reducing selling prices, should be investigated.

We are ready to talk with you whenever you are ready to talk with us, about this very important cost phase of meeting competition.



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maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

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CLEVELAND · OHIO

on EMERSON-ELECTRIC AIRCRAFT MOTORS

After rigid tests at numerous stages of manufacture, Emerson-Electric Aircraft Motors, in accordance with specifications, are subjected to the Vibrometer test. Vibration testing is an accurate and practical method of determining balance of all rotating parts in the assembled motor. Here the motor is "floated" by springs and rubber pads and operated under the "eye" of a sensitive light beam Vibrometer, which detects any unbalanced condition.

This is but one of many exacting tests of materials and assemblies which are important in the manufacture of precision-built motors for combat service airplanes.

For full information on Emerson-Electric Aircraft Motors, send for Bulletin X4745.

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EMERSON-ELECTRIC AIRCRAFT MOTORS are made for gun turret drives, hydraulic units, fuel pumps, actuators, winterizing units, communication systems—also with built-in gear and magnetic brake.

406

EMERSON ELECTRIC

MOTORS · FANS — APPLIANCES

Briggs Mfg. Co. exhibited baked plaster molds and representative castings made from brass, bronze, and aluminum. The process is said to be competitive, producing unusual dimensional fidelity, faithful reproduction of fine details, and attractive as-cast surfaces.

Space limitations prohibit a further direct mention of materials and products and producers who were represented at the Cleveland show. Apart from an amazing variety of products and technical processes, there were shown plastic molding machines, pipe bending machinery, small lathes, tools, gages and instruments, grinding wheels and grinders, hydraulic presses, Ultra-Lap machines, and a number of air-controlled devices for chucking and for work-holding fixtures. In this group was a line of toggle-action clamping tools made by Knu-Vise, Inc.

Aluminum Industries, Inc., had a display of Permite aluminum alloy castings, Permite screw machine parts, Permite aluminum paints and industrial finishes.

Spotwelding and Forming of Aluminized Steel

(*Continued from page* 34)

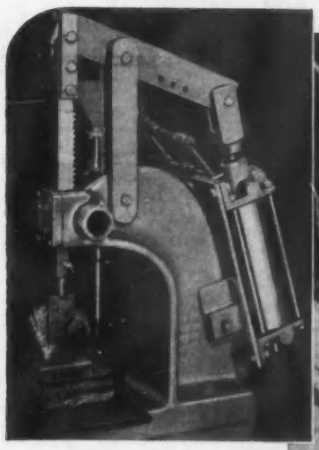
When the brake specimens were bent, no flaking of coating was observed in any bend. Breaks across or with the grain made no apparent difference in the bends. In all specimens the coating showed surface cracks, the most severe being in the 1t bend radius. These cracks did not appear to be detrimental as they are very small and seemed to heal by re-oxidation of the coating. At the inside of the bends the coating took compression with visible wrinkling but with no apparent flaking.

Results for the Channel Cowl Stiffener tests parts formed on dies are shown in Table II.

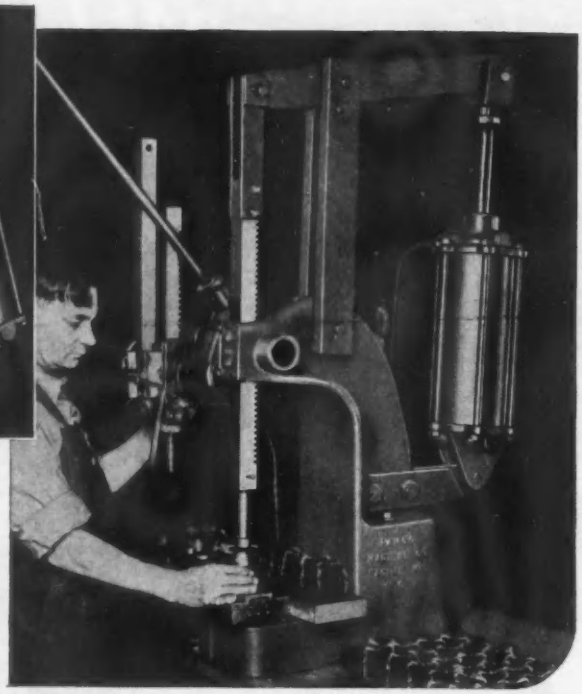
The "slight torch heat" applied to parts in the table was purely experimental and not a production method. The part was passed four times through a gas air flame just before striking. No temperature control was attempted. The purpose was to observe any possible difference in adhesion of protective coating when formed while hot. This treatment made a slight improvement in "as received" material but made no apparent difference in the heat treated specimens.

The other two parts mentioned were formed under the same conditions as part (1). The forming of part (2) was so severe that no really good results were obtained. The coating flaked and peeled in all instances but the heat treated parts were much improved in this respect over those in the "as received" condition. Part (3) required much less severe forming than either of the other blanks. No flaking or peeling was observed in any of the parts formed. The aluminum coating on the heat treated parts showed less cracking at bends than that of the "as received" material.

Subsequent to tests outlined in Table II, further tests were made on forming part (2) using blanks soaked at temperature of 650 F for 15 min, 30 min, 1 hr, 2 hr, 4 hr, 8 hr, 16 hr, and 24 hr. This test showed progressively better bond of aluminum coating to base metal up to 4 hr at heat. At 4 hr the bond was excellent and beyond that time there is no apparent betterment. It was definitely established that soaking at 650 F for 4 hr will permit severe forming of this material. It should be pointed out that dies for this material should be of such design that scraping of the coating does not occur. The conclusion drawn from this investigation was that should the need arise Boeing could with their available facilities successfully form and spotweld aluminized steel parts for their Flying Fortresses.



Small arbor press to crimp wire, powered by a small Model A NOPAK Cylinder mounted on hinged base.



Hand and air power both are used in this dual press equipped with 10" NOPAK Model E Cylinder.

Air Cylinders STEP-UP BRUSH PRODUCTION!

With new machinery and experienced help hard-to-get . . . the wartime demand for circular wire brushes created a real problem for The Milwaukee Brush Mfg. Co. Modernization of existing equipment was the happy solution . . . increased production ten-fold with only twice as many workers.

A vital step in this modernization was the application of air cylinder power to various types and sizes of arbor presses which perform many of the holding, clamping and squeezing operations in assembling these brushes. Altogether, nearly twenty machines were converted to air operation. Foot control valves leave the operators' hands free to manipulate tools, dies and parts for speedy assembly.

Perhaps some of your machines can be modernized through the application of air or hydraulic power. NOPAK Cylinder Bulletin 82 can help you decide. Write for it.

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Representatives in Principal Cities

NOPAK VALVES and CYLINDERS

DESIGNED for AIR or HYDRAULIC SERVICE

A 4552-½I

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PRESSURE SENSITIVE ADHESIVE

Is Your REAL Problem Hidden under a Lot of Little Ones?

Possibly your operational costs can be reduced measurably by a simple Industrial Adhesive Tape *use* you have not yet discovered. It can be, too, that you could climb to new highs in production in the same process.

Searching out hidden problems in your plant—helping you to solve perfectly apparent ones—is as much our job as supplying the finest Industrial Adhesive Tape. In some plants we've actually helped cut tape costs 15% to 45% . . . and general plant operations have been speeded up, with lowered costs . . .

Nearly half a century of experience in making many kinds of adhesive tapes counts a lot in this job we do. By careful, thorough analysis of your *specific* problems, by testing and retesting when necessary in our laboratories, we may out of our experience help you and your engineers uncover some really big problem that has been obscured by a lot of baffling little problems . . . *and solve both big and little!*

We are at your service. Why not write, without obligation, to Dept. 311, and set a time when our trained sales engineers may consult with you on your *specific* problems?

CASE HISTORY No. 11

Production of fighter and bomber planes requires the making, forming and finishing of from 600 to 1800 highly precisioned tubes which must be sealed at both ends against dirt and corrosion. And it was desired that they also be made tamper-proof before final assembly.

Bauer & Black, in collaboration with aircraft engineers, solved the problem by developing Picotape specifically for this purpose. Costs were lowered; the stocking and handling problem was simplified. Rejects were reduced to a minimum.

Whether your problem is large or small, you too may find our research mightily worthwhile. It's yours without cost.

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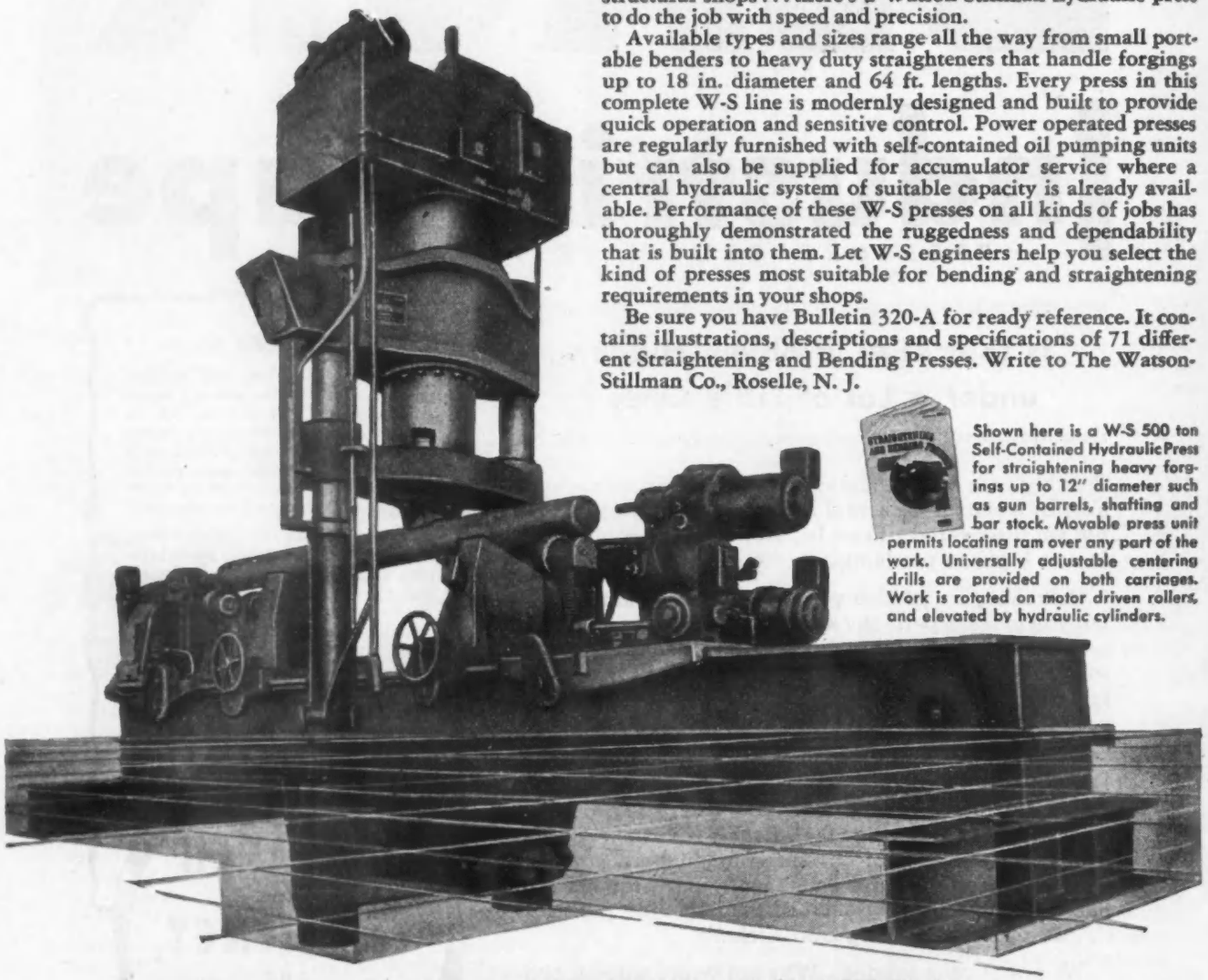
Speed STRAIGHTENING AND *BENDING* JOBS with W-S "Service-Tested" Presses

For any kind of straightening and bending operation on castings, shafts, bar stock, rough and finished forgings, pipe, plates, structural shops . . . there's a Watson-Stillman hydraulic press to do the job with speed and precision.

Available types and sizes range all the way from small portable benders to heavy duty straighteners that handle forgings up to 18 in. diameter and 64 ft. lengths. Every press in this complete W-S line is modernly designed and built to provide quick operation and sensitive control. Power operated presses are regularly furnished with self-contained oil pumping units but can also be supplied for accumulator service where a central hydraulic system of suitable capacity is already available. Performance of these W-S presses on all kinds of jobs has thoroughly demonstrated the ruggedness and dependability that is built into them. Let W-S engineers help you select the kind of presses most suitable for bending and straightening requirements in your shops.

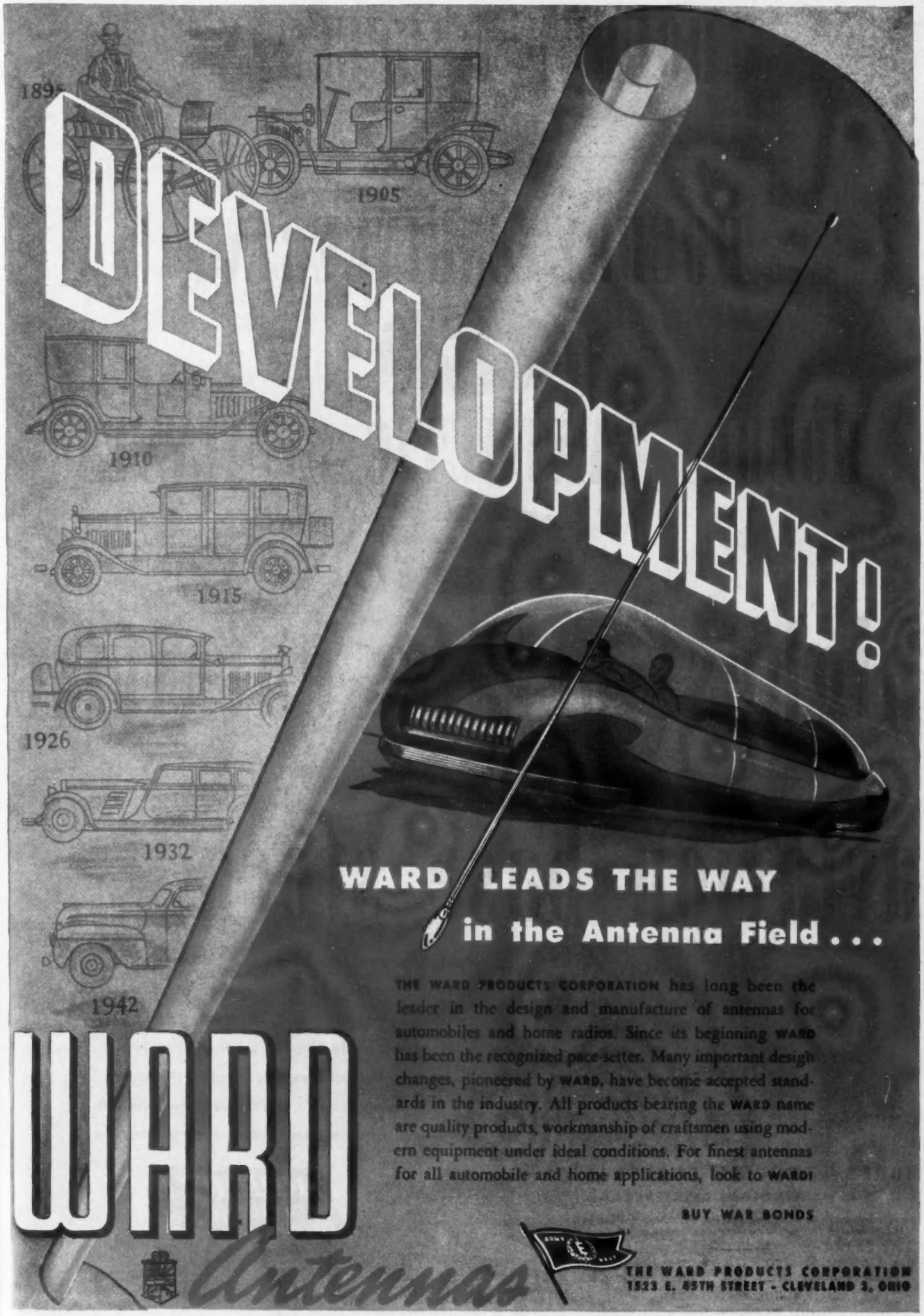
Be sure you have Bulletin 320-A for ready reference. It contains illustrations, descriptions and specifications of 71 different Straightening and Bending Presses. Write to The Watson-Stillman Co., Roselle, N. J.



Shown here is a W-S 500 ton Self-Contained Hydraulic Press for straightening heavy forgings up to 12" diameter such as gun barrels, shafting and bar stock. Movable press unit permits locating ram over any part of the work. Universally adjustable centering drills are provided on both carriages. Work is rotated on motor driven rollers, and elevated by hydraulic cylinders.

WATSON-STILLMAN

Designers and manufacturers of Hydraulic Equipment, Forged Steel Fittings and Valves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highest-octane catalytic aviation base stock!

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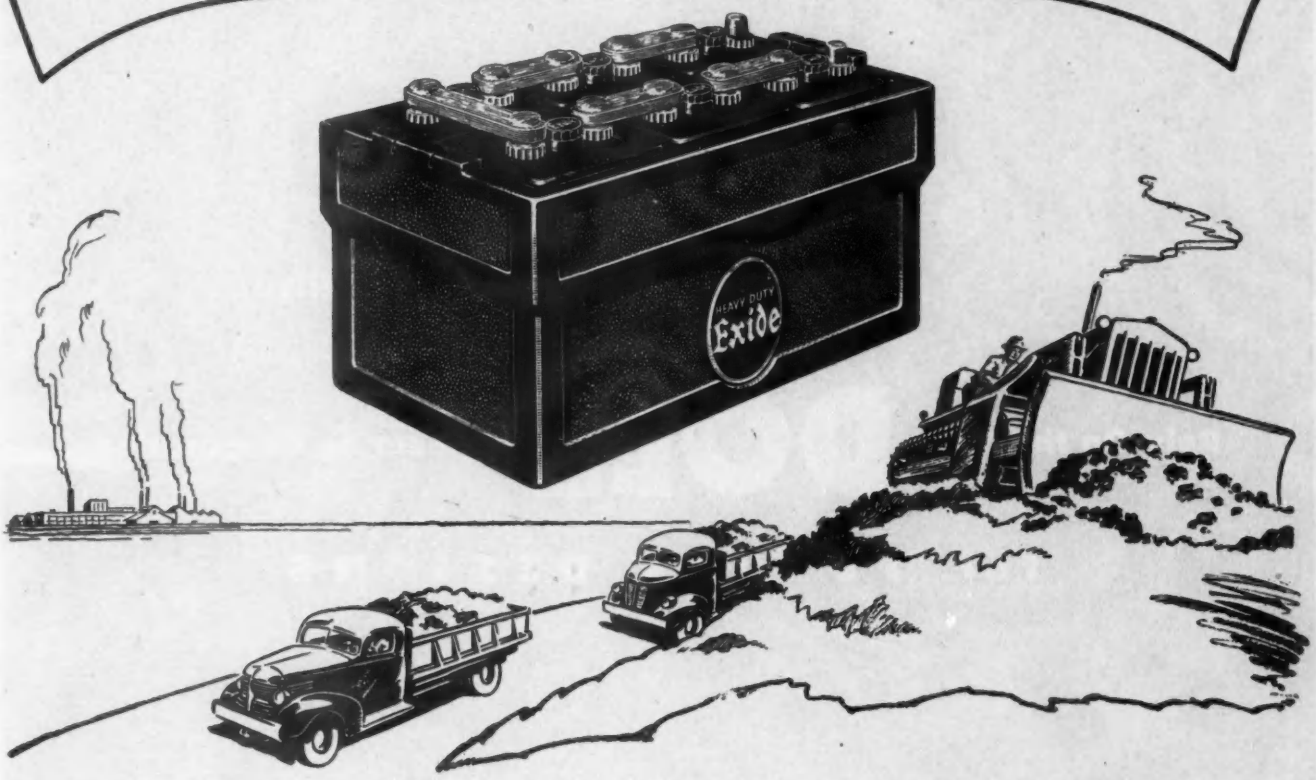
EXIDE BATTERIES

for peak performance where the going is extra tough



EXTRA tough service is the common lot of most automotive equipment in use today. And, both on and off the highway, this equipment is winning against the biggest odds of all time. To the automotive engineer much of the credit should go, for he has kept well ahead of the newer needs by designing and building for harder service, rougher handling and heavier loads.

Battery engineering, too, has kept pace with these newer needs. Evidence of this may be seen in the fine service records being made by Exide Heavy-Duty Batteries in all parts of the world—and in all climates. Exides are powering the electric units, are cranking the Diesels in thousands upon thousands of trucks, tractors and other heavy-duty equipment. And they are performing with dependability, long-life and ease of maintenance.

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THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
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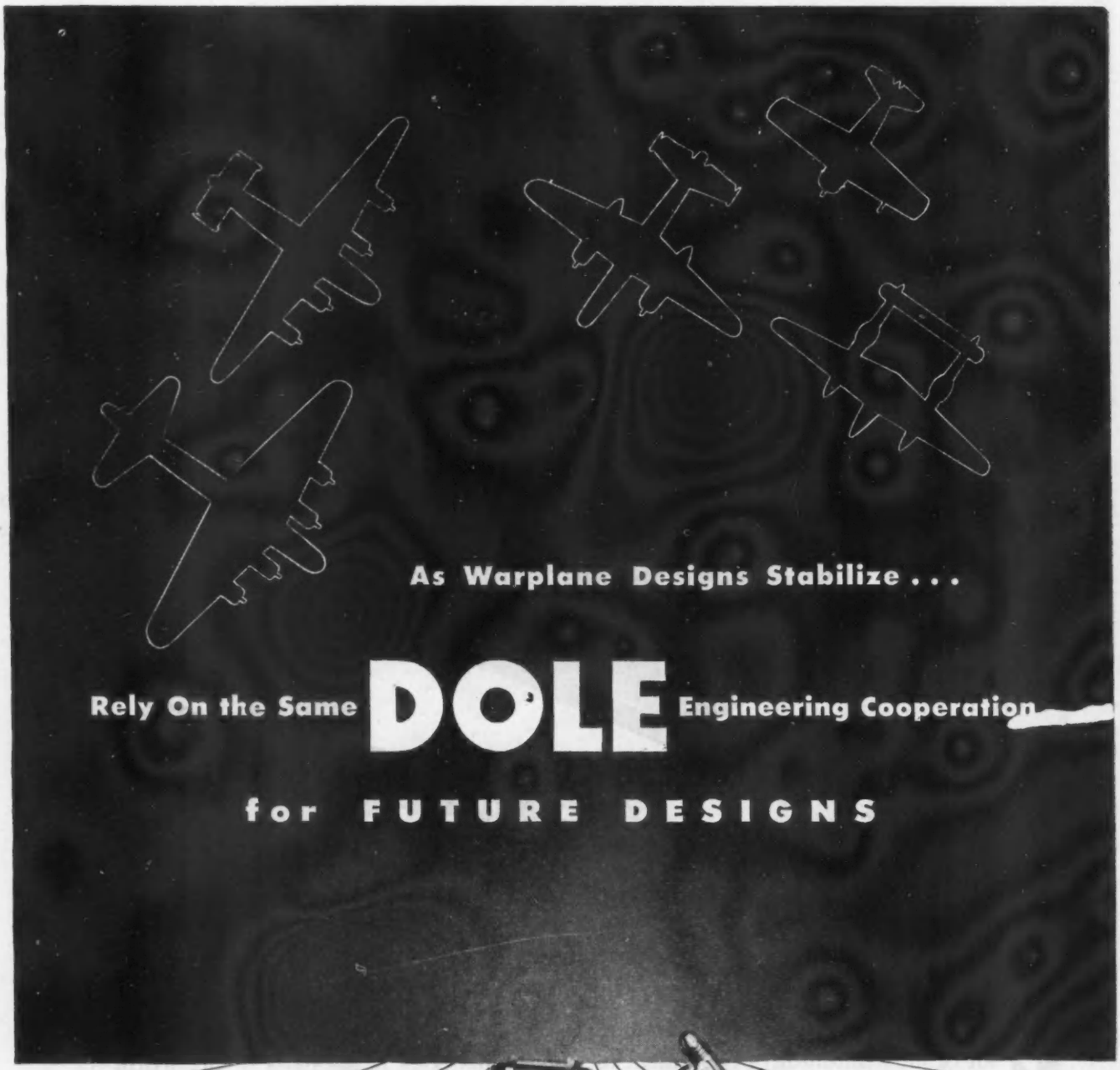

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The New and Amazingly Versatile "Weasel"— Equipped with Dependable Spicer Propeller Shafts, Universal Joints and Gears!

This new track-laying Army vehicle, made by Studebaker, is just as much at home in water as it is on snow, sand, mud, swamp or solid ground. It not only propels itself in deep water, fully loaded, but also clambers up and down steep, slippery banks and hills with amazing ease, negotiating ground conditions that would stall other military transportation units. Dependable Spicer gears help keep the "Weasel" in active service on the war fronts of the world . . . and these same dependable gears again will serve civilian motor transportation when peacetime manufacturing is resumed. Spicer Manufacturing Corporation, Toledo, Ohio.

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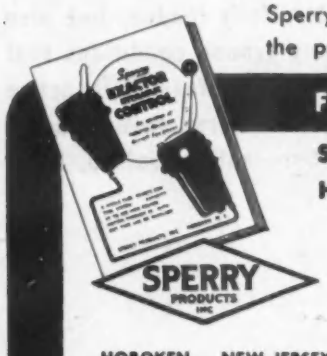
SPERRY'S EXACTOR HYDRAULIC CONTROL MAY SOLVE IT

Sperry's EXACTOR HYDRAULIC CONTROL, by means of a flexible, unique, single-tube system, has solved hundreds of remote control problems for design engineers in many industries.

Accurate and self-contained, requiring no special engineering to install or maintain, the EXACTOR HYDRAULIC CONTROL is well worth investigating.

Installation is simple and quick, because the EXACTOR uses tubing that can be bent *around* obstacles — thus eliminating all design problems. If *you* have a control problem involving the accurate transmission of applied motion over distances up to 200 feet, send for our completely descriptive booklet.

Sperry's EXACTOR HYDRAULIC CONTROL is rated at 400 inch-pounds on the pressure stroke and 100 inch-pounds on the spring-return stroke.



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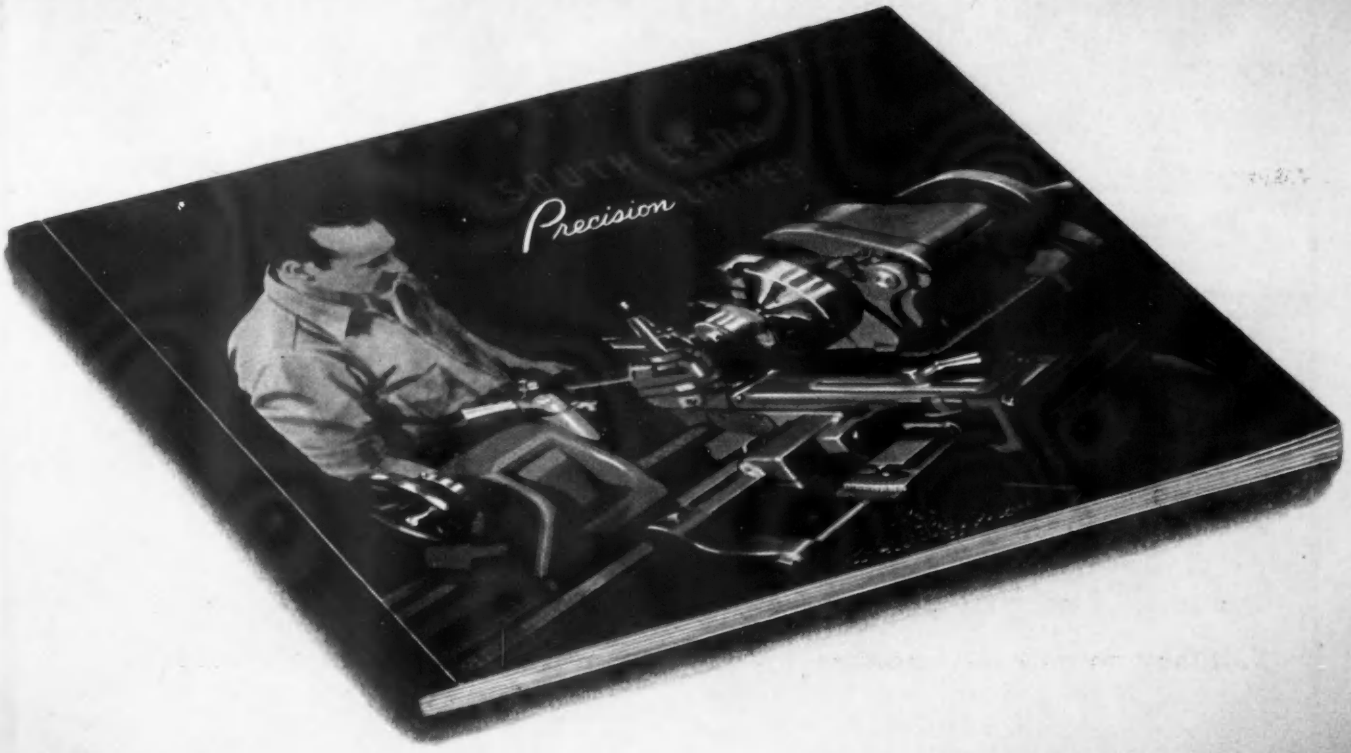

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Engine Lathes — 9″ to 16″ swing, 3′ to 12′ bed length
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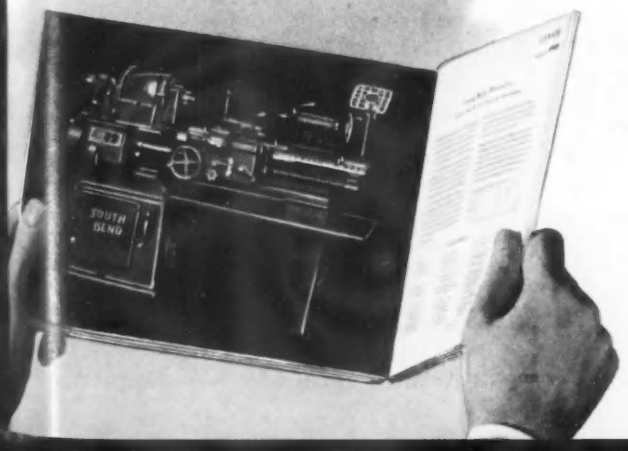

All sizes and types of South Bend Lathes are clearly illustrated in color in this new catalog. Complete specifications including capacities, speeds, feeds, and weights are printed opposite the illustration of each lathe. Practical attachments and accessories are also shown. Every user of machinery should have a copy of this catalog at hand for ready reference. Contains 64 pages, size 11″ x 8½″ for standard file. Write today for your copy of Catalog 100D.

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FENN FOR SPECIAL MACHINERY

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Reconversion to peacetime production is the problem that every manufacturer faces. Plans may necessitate redesigning present machines and building new ones. There is no time to waste.

The survival of many plants will depend largely upon the careful planning that they do now for machines and tools to be used in postwar production.

When you engage FENN to build your special machinery you gain the benefit of their sound practical shop experience, their knowledge of machine design which has been accumulated through *three generations.*

Fenn Engineers invite inquiries from concerns who are looking for ways to make their product better, faster, or for less money — concerns that are ready to talk about production at a profit.

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Builders of Better Machinery To Meet New Demands

The lights go up

ON PHOTO-REPRODUCTION!

Now you can make photographic contact-prints from your pencil originals in a normally lighted room. No semi-darkroom—NO NEED TO DIM LIGHTS. No danger of fogging. No trouble in handling.

THE OLD DIMMED-LIGHT METHOD

THE NEW PEERLESS PHOTO-ARC WAY

And quality goes up, too!

A revolutionary improvement in contact papers! The new Photo-Arc anti-diffusion emulsion gives greater latitude, greater contrast, greater density than ever before—hence greater legibility. CLEAN, SHARP LINES. No fuzziness. No lost details.

PEERLESS PHOTO-ARC
REPRODUCTION PAPERS

give you every advantage that the *best* of other papers can give—*plus* three big advantages that *no* other papers can give!

1. The *only* silver-emulsion reproduction papers which can be run in *any* kind of continuous blueprint machine.
2. The *only* papers which can be handled and processed without dimming lights.
3. The *only* reproduction papers of *any* type which incorporate the new anti-diffusion characteristics. This exclusive Peerless development greatly improves definition and permits full, non-critical exposures without closing up or losing fine lines.

Send for literature giving full information

INDUSTRIAL PEERLESS PHOTO PRODUCTS SHOREHAM, L.I. NEW YORK PHOTO PROCESSES

Manufactured only by

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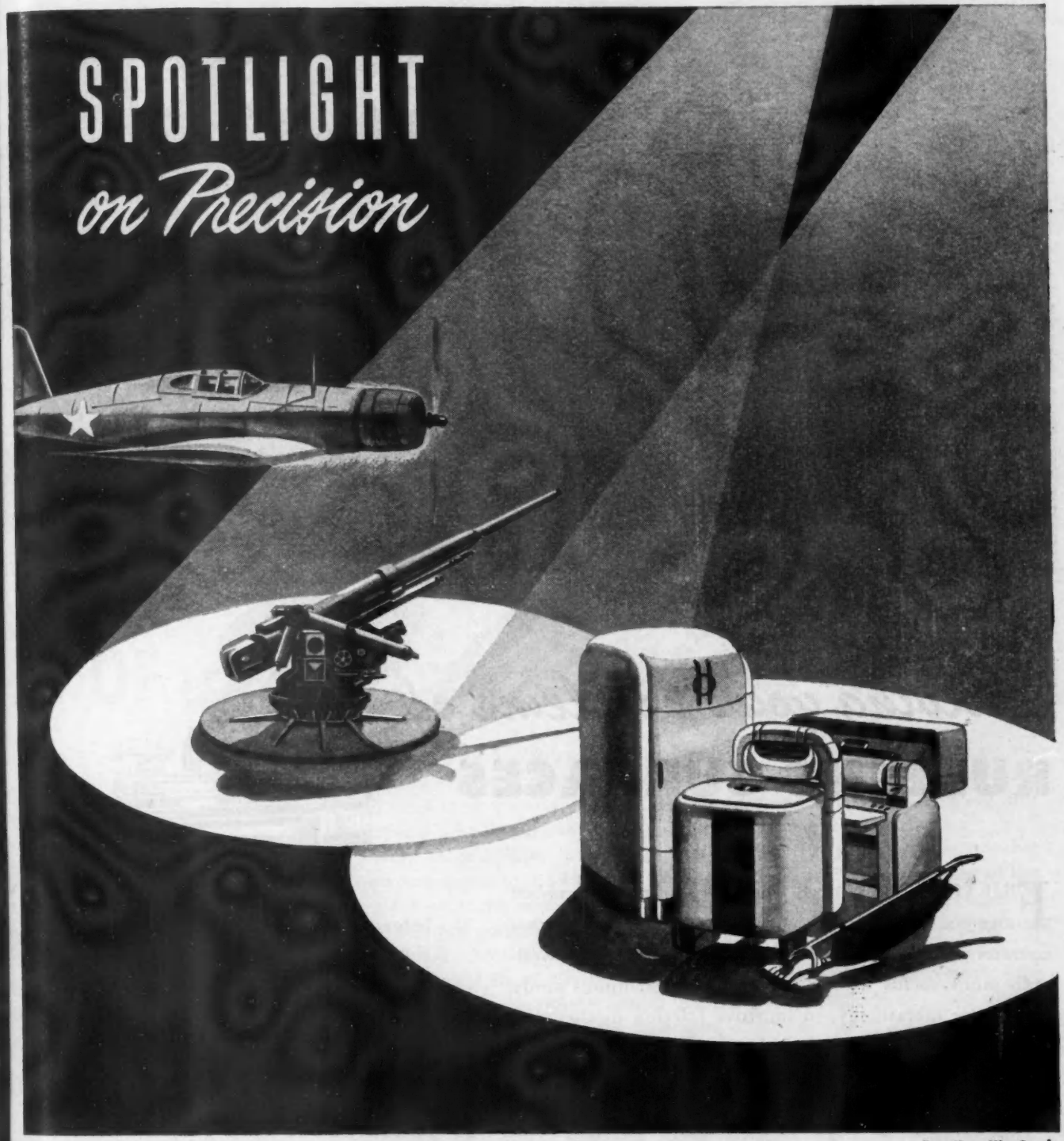
Top by
MOTOR STATE
PRODUCTS COMPANY, YPSILANTI, MICHIGAN
Originators of the hydraulic push-button top



Buy More War Bonds

Spotlighted in today's war production program are the hardened and precision ground parts made *in great volume* by Allied Products Corporation. Some of these parts, which are being made for top-flight aircraft engines, guns and other matériel of war, are finished to within limits of two ten-thousandths of an inch.

Projected into the postwar period, the facilities which have made possible Allied's wartime accomplishments will provide a deep reservoir of craftmanship, mass production machinery, and practical experience for manufacturers of consumer goods.

If you are planning a postwar product, and are looking for a dependable, economical source of tools and hardened and precision ground parts, get in touch with Allied Products Corporation now.

"IT'S AN ALLIED PRODUCT" . . . Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, also make: Sheet metal dies, from the largest to the smallest; steam-heated plastic molds; jigs and fixtures, the original R-B Interchangeable Punch and Die; cap screws; cold forged parts; and other products.

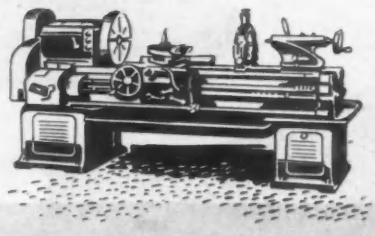
ALLIED PRODUCTS
CORPORATION

Executive Offices: 4646 Lawton Ave., Detroit 8, Michigan

All Four Plants Have Added Stars To Their Army-Navy "E" Pennants

At the control panel, this project engineer is studying the results of a test on one of the many Wellman dynamometers.

Solving your problems of RUBBING SURFACES



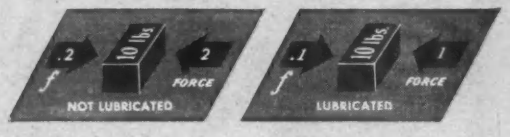
FRICTION is developed when two surfaces are rubbed together. Friction lights a match . . . and it's friction that operates your clutches and brakes. In the great S. K. Wellman laboratories we are engaged in continuous study of powder metallurgy, to improve friction qualities of Velvetouch *all-metal* clutch facings and brake linings . . . to bring you dependable friction materials *engineered to your exact specifications.*

You can safely specify Velvetouch for rugged, heavy duty operating conditions in all types of industrial machinery.

THE S. K. WELLMAN COMPANY
1374 EAST 51st STREET • CLEVELAND 3, OHIO

Interesting Facts About FRICTION

If two rubbing surfaces are separated by a film of oil, the friction is almost independent of the nature of the surfaces.



As shown in the illustration, a 10 lb. block sliding on a non-lubricated surface, requiring 2 lbs. of force, has a .2 coefficient of friction. When the surface is lubricated, however, the force required is only 1 lb. and the coefficient of friction drops correspondingly to .1. As lubrication decreases, the coefficient of friction becomes more dependent upon the material of the surfaces.

For Brake and Clutch . . . Use Velvetouch

Velvetouch is *all metal*— a combination of powdered metals, compressed, sintered and welded to a solid steel backing plate.

OF *Self-locking* NUTS

The Stover Self-locking Nut is a beautiful example of precision manufacturing—but it "packs tremendous stamina." Sixteen precision machines are employed to make and test it—and to give the vibration-defying ***grip*** that spotlights the Stover nut among modern fasteners.

New in principle, the Stover Self-locking Nut represents a notable advance over other locking devices, especially in its employment of the natural elasticity of metal to give it holding power; its one-piece construction without complicated assembly, and its ability to lock firmly at any point on the bolt.

Evidence of the efficiency of the Stover Self-locking Nut multiplies rapidly in war production where, under Army-Navy specifications, it is giving exceptional resistance to the loosening effects of vibration.

For
BETTER AFTER-THE-WAR MACHINES

Every machine that vibrates will be a better machine if fastened with Stover Self-locking Nuts. Ask to have our representative call on you in relation to your post-war plans.

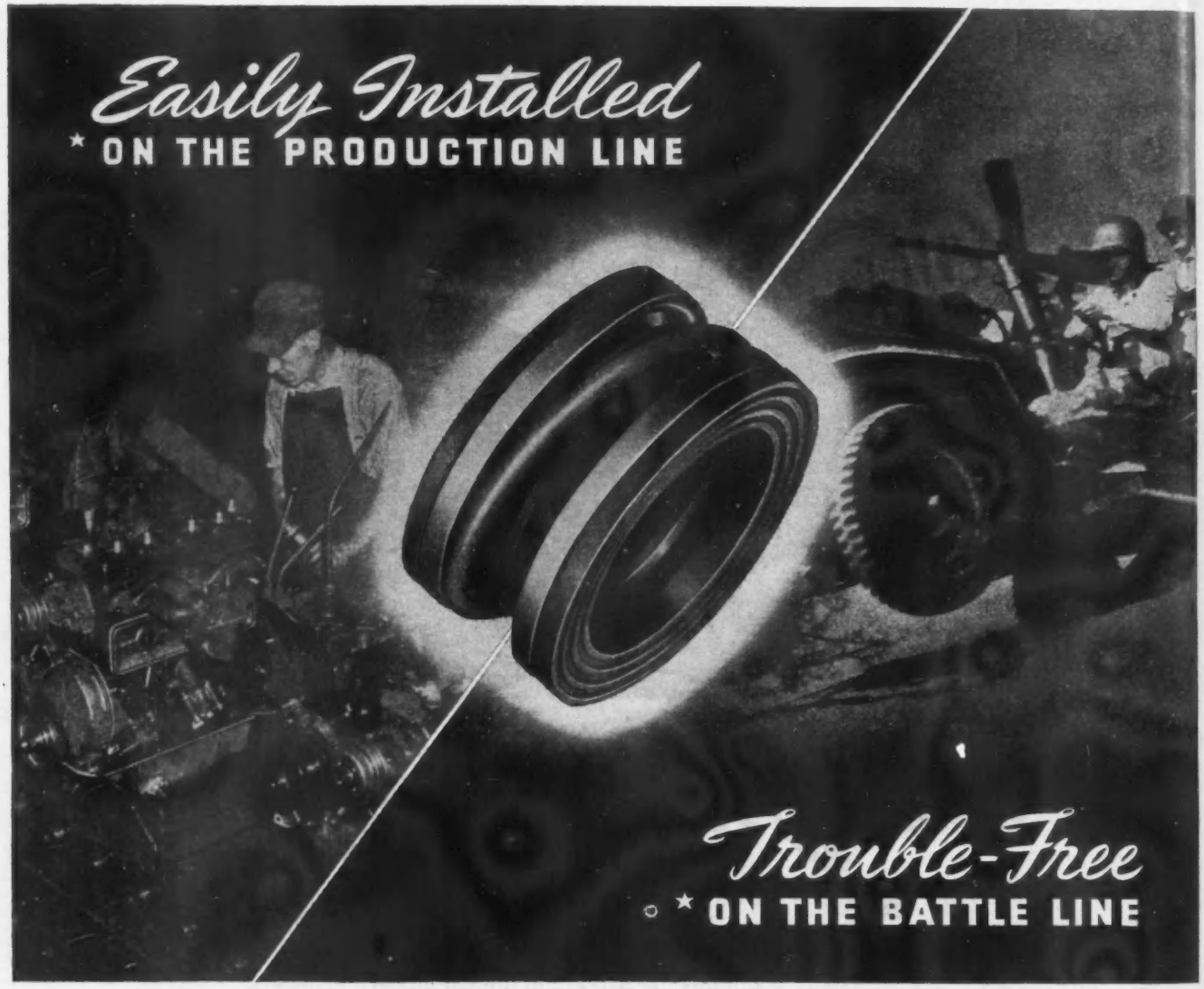
● *May we send you descriptive literature and samples?*

STOVER
SELF-LOCKING NUT
"IT WON'T SHAKE LOOSE"

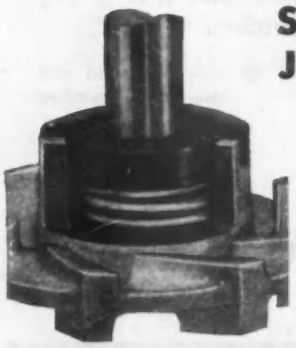
STOVER LOCK NUT AND MACHINERY CORPORATION

Easton, Penna., Bushkill Drive · New York 17, N. Y., 101 Park Avenue · Detroit 2, Mich., General Motors Building

REPRESENTATIVES IN PRINCIPAL CITIES



The JOHN CRANE Bellows PUMP SEAL

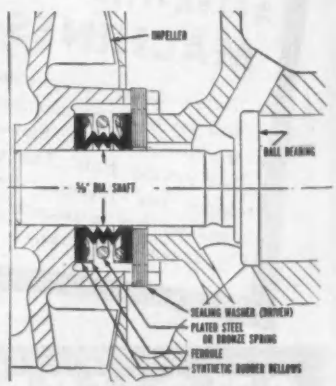


Seal and Washer in Operating Position (Under Load)

STANDARD EQUIPMENT . . . ON JEEPS, TANKS, TRUCKS, AIRCRAFT

- *Flexible*—Spring and bellows are self-adjusting.
- *Simple*—Consists only of the factory assembled bellows and spring, and a sealing washer.
- *Easily installed*—Assembly fits shaft loosely; slides easily into place, either end first (the two ends are identical).
- *Dependable*—Service records show perfect operation at 100,000 miles and more.

Ask for illustrated Bellows Pump Seal Bulletin



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BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

PAGE *Welding* ELECTRODES

NEW!

for AC *or* DC

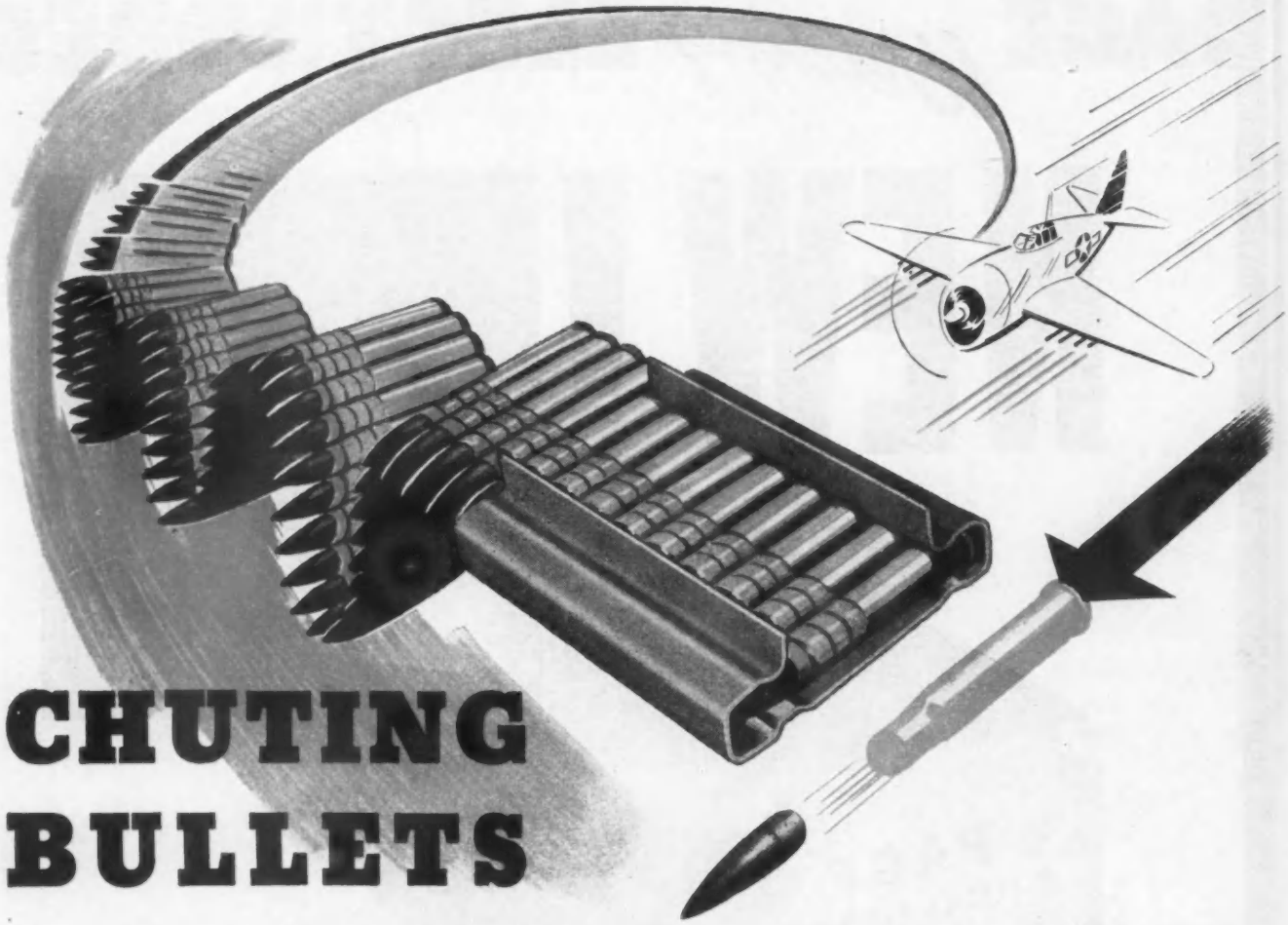
Here's the newest member of the **PAGE** Electrode family. It is a general-purpose electrode, especially designed for welding light-gage mild steel in flat, vertical, overhead and horizontal positions with either alternating or direct current. The **PAGE HI-TENSILE AF ELECTRODE** produces an exceptionally smooth and uniform bead, slightly convex. This makes it most satisfactory for fillet and lap welds. For further details about this new electrode, get in touch with your **PAGE** distributor.

PAGE STEEL AND WIRE DIVISION
Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York, Pittsburgh, Portland, San Francisco

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT · CONNECTICUT

ESSENTIAL PRODUCTS • TRU-LAY Aircraft, Automotive, and Industrial Controls • TRU-LOC Aircraft Terminals • AMERICAN CABLE Wire Rope • TRU-STOP Brakes • AMERICAN Chain • WEED Tire Chains • ACCO Malleable Castings • CAMPBELL Cutting Machines • FORD Hoists, Trolleys • HAZARD Wire Rope • MANLEY Auto Service Equipment • MARYLAND Bolts and Nuts • OWEN Springs • PAGE Fence, Shaped Wire, Welding Wire • READING-PRATT & CADY Valves • READING Steel Castings • WRIGHT Hoists, Cranes • WILSON "Rockwell" Hardness Testers

In Business for Your Safety



CHUTING BULLETS

into firing position with strong, lightweight MICARTA

PULLEYS of Micarta extend life of both pulley and cable. Millions are now in use in Allied aircraft.

ANTENNA MASTS of Micarta hold the antenna taut without yield or wobble . . . withstand wide extremes of pressure and temperature.

BOMB RACKS have been successfully molded of Micarta . . . furnish an excellent example of Micarta's strength and the skill of Westinghouse engineers in intricate molding assignments.

Micarta

THE SYNTHETIC PLASTIC

Bullets for a plane's chattering wing-guns are stored in long, looping belts. To guide each bullet accurately into firing position, plane makers are now using chutes formed of *MICARTA—"444"*, the light, strong sheet plastic. Here's why:

MICARTA weighs approximately one-half as much as aluminum of equal strength—helps eliminate superfluous weight in the plane.

MICARTA rates high in flexural, compressive and impact strength. In high altitude flying, as temperatures decrease, Micarta acquires added tensile strength.

MICARTA "444" is easily and quickly produced with inexpensive wooden molds. Sheets are subjected to heat and pressure, and formed into strong, intricate shapes.

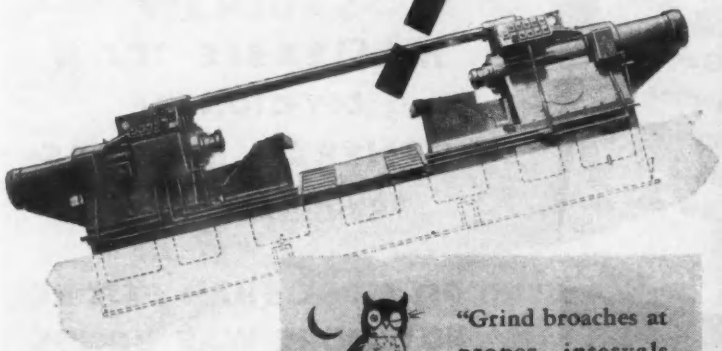
This new Micarta "444" was originally developed for the aircraft industry and is now accepted for use as trim tab fairing, accumulator covers, aviator's chart cases, fuselage tailwheel housing, wing-gun ejection chutes. For further information, and a copy of the New Micarta Data book (B-3184-A) write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-06346

Putting "Hep" IN THE "CATS"!

NEWSWEEK of August 28 reports of Lieut.-General George S. Patton, Jr., as follows: "If he had to choose between tanks and bulldozers for an invasion he would choose road-building equipment every time." More than a construction machine, the bulldozer has been a powerful factor in winning many battles.

To quickly, efficiently fit axle shafts and bearing cups into bulldozer transmission cases, *American* engineers designed a special horizontal assembly press. A conveyor line brings the cases to the machine and removes them after operations are completed. The part is stopped, locked in position, pressed, and released by this hydraulically operated, push button controlled machine.

This is another example of how the American Broach and Machine Company help leading manufacturers increase output of vital war materials. When the war job is done, *American's* complete service of machines, tools, and engineering will be available to speed manufacture of civilian goods. Let *American* engineers show you how broaching or special machinery can solve your production problems. Write today for details.



"Grind broaches at proper intervals to prevent loss of broach life."

MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO.

Design that part in ArmaSteel* and cut machining time as much as 50%

Widely used to replace plain-carbon and low-alloy steels, ArmaSteel has effected remarkable savings in the production of varied parts for war equipment and pre-war products.

Fundamental savings are two-fold: 1. Compared to forgings and bar stock, ArmaSteel greatly reduces the amount of metal to be removed, since it is cast to conform closely to final shapes. 2. ArmaSteel gives 10% to 50% better machinability, with a 20% to 100% increase in the number of parts finished per tool grind. Experience in the broaching of a particular gun part shows approximately 15,000 pieces obtained per tool grind without the use of a coolant.

Successful applications of ArmaSteel range from gun parts weighing less than a pound, to Diesel locomotive pistons weighing more than 50 pounds. We suggest that you investigate the advantages ArmaSteel may provide in your manufacturing operations.

*Reg. U. S. Pat. Off.

Do These Properties and Qualities Interest You?

Excellent Machinability • Ready response to selective hardening • Hardenability comparable to 5040-A steel • Good fatigue life • Excellent bearing properties (eliminates need for bushings in many applications) • Polishes to mirror finish • Good damping characteristics • Low coefficient of thermal expansion.

SAGINAW MALLEABLE IRON
DIVISION OF
GENERAL MOTORS
Saginaw, Michigan

★

DO MORE THAN BEFORE
BUY MORE WAR BONDS

★

CAST FOR A LEADING ROLE IN INDUSTRY

Forget fuel line Failures

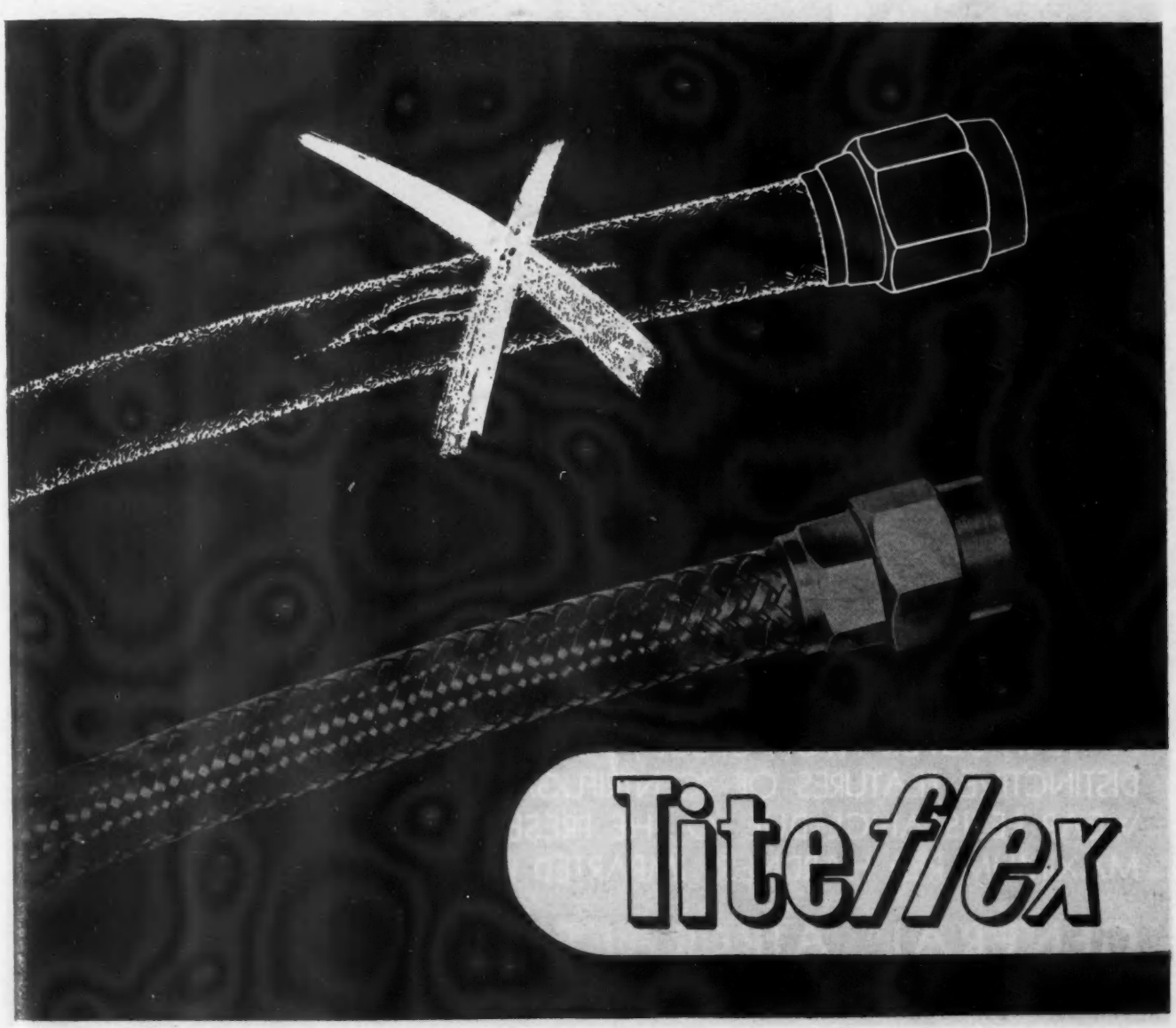
. . . IN HEAVY-SERVICE INSTALLATIONS

WHY DO FUEL LINES FAIL? Oil lines and air lines . . . on trucks and busses?

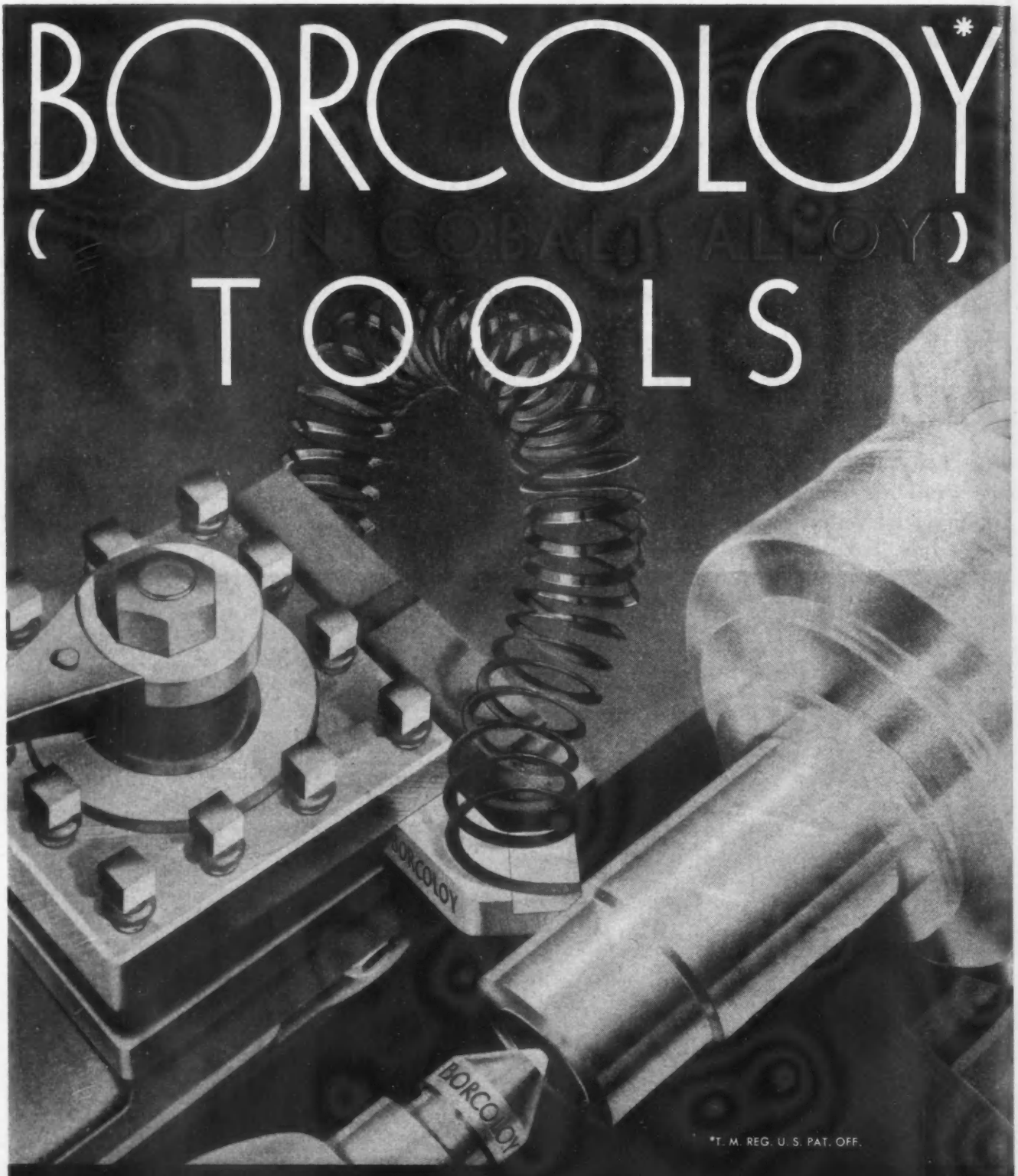
- They fail through vibration . . . through heat . . . and cold . . . through destructive chemical action on nearly all types of materials.
- But flexible lines of Titeflex last longer . . . and for reasons just as obvious . . .
- First . . . Titeflex is *all-metal.* Engine heat has no effect on it . . . and it can't be damaged by oil, gasoline, or water.
- Second . . . the all-metal convoluted core and woven-on metal braid covering of Titeflex provide a soft, springy resiliency that simply "eats up" vibration.
- Third . . . Titeflex is really *tight.* Being *all-metal* . . . without packing in joints . . . it's inherently leak-proof.

As a manufacturer, you'll want to specify Titeflex as original equipment. As a fleet operator or maintenance man you'll want to use it for replacing other type flexible lines on all heavy-duty installations. Specify Titeflex — for flexible lines that last longer.

TITEFLEX, INC.
507 Frelinghuysen Avenue
Newark 5, N. J.



BORCOLOY*
(BORON COBALT ALLOY)
TOOLS



*T. M. REG. U. S. PAT. OFF.

A NEW, SUPER HIGH-SPEED, TOOL STEEL WITH, (1) ALL THE DISTINCTIVE FEATURES OF "CENTRIFUGALLY CAST" ALLOYS, (2) HIGH WEAR RESISTANCE DUE TO THE PRESENCE OF BORON AND (3) A MAXIMUM RED HARDNESS IMPARTED BY TWENTY PERCENT COBALT

GENERAL AIRCRAFT EQUIPMENT, INC.
SOUTH NORWALK, CONN. TOOL DIVISION

DeWALT ANSWERS INDUSTRY'S NEED FOR A VERSATILE ALL-PURPOSE CUT-OFF SAW!

Here's a DeWalt that you can use for many jobs anywhere in your plant *now!*

DeWalt is the ALL-PURPOSE machine that can be changed quickly, as required, from a straight-line cut-off saw—to miter saw—to rip saw—to dado machine—to shaper—or other operations that can be made with circular cutting tools.

Investigate DeWalt. Install a DeWalt. Reduce cutting costs. Simplify materials handling. Eliminate waste. Save time. DeWalt is available in models ranging from ½ H.P. to 10 H.P. Send coupon below for full information.

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5807 Fountain Avenue, Lancaster, Penna.
Please send me information on your complete line.

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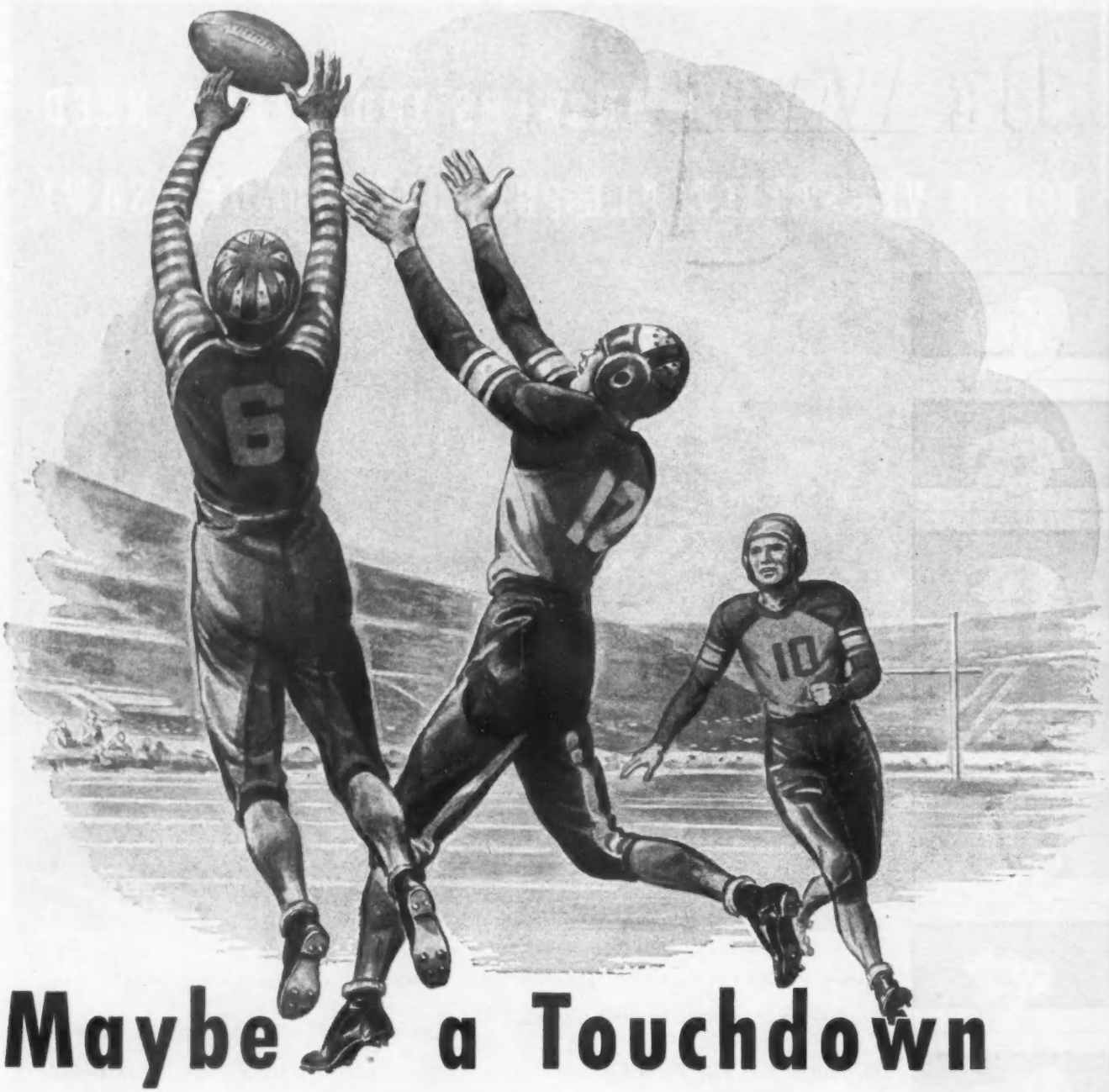
City .....

DeWALT
Makes Every Cut Possible With a Circular Saw



Maybe a Touchdown

Hamilton Steam and Diesel Engines, Cannon and the Machine Tools to make them.

BUT KEEP THAT GUARD UP!

GENERAL MACHINERY CORPORATION

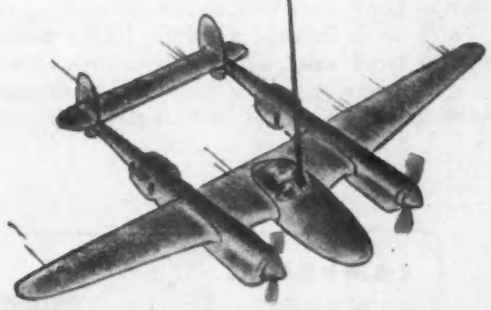
HAMILTON, OHIO

THE NILES TOOL WORKS COMPANY • THE HOOVEN, OWENS, RENTSCHLER CO. • GENERAL MACHINERY ORDNANCE CORPORATION

Confidence...

IN HIS COMMANDER *and his* EQUIPMENT

In this highly mechanized war, the fighting man must have as much faith in his equipment as he has in his leaders. Harvey-Wells electronic units are precision war machines which have earned the full confidence of the Armed Forces under battle conditions. In addition to rugged construction and dependable service, the many exclusive features developed entirely in Harvey-Wells laboratories will be found in all our products designed for commercial and civilian use. If you are interested in high-grade equipment covered by factory service, we solicit your inquiries.



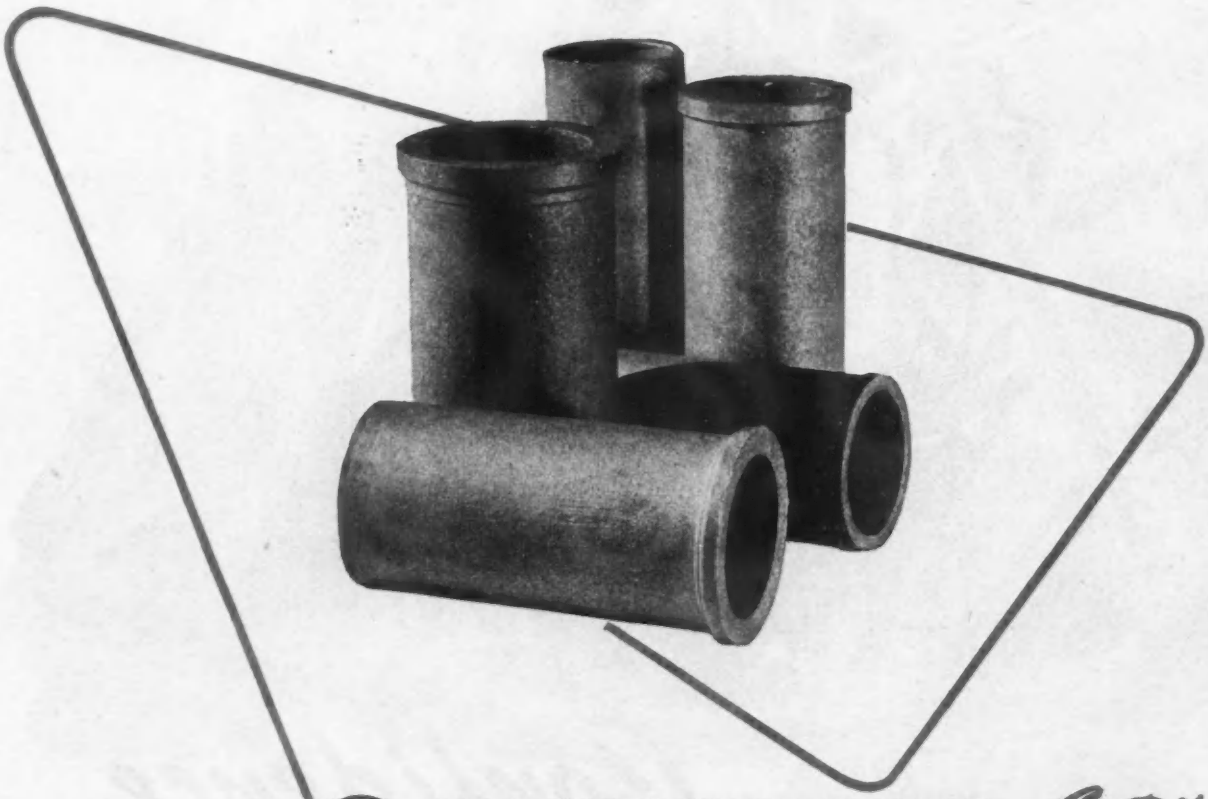
Communications
Aids to Navigation
Electronic Safety Devices

Know the company that wants your business! Our CASE BOOK tells the story of Harvey-Wells and its place in Electronics. Send for it today. Your name on your letterhead is sufficient.

Harvey-WELLS
ELECTRONICS

HARVEY-WELLS ELECTRONICS, INC. SOUTHBRIDGE, MASSACHUSETTS

HOW ARE YOUR CYLINDER LINERS MADE?



C.W.C. CASTS CYLINDER LINERS *Centrifugally* AND HERE'S WHY!

Centrifugal casting assures absolute uniformity! The elimination of gas, slag, and foreign matter by centrifugal force provides added qualities of strength, density and structure. Soft spots due to gates and risers are also prevented in this *modern* casting process.

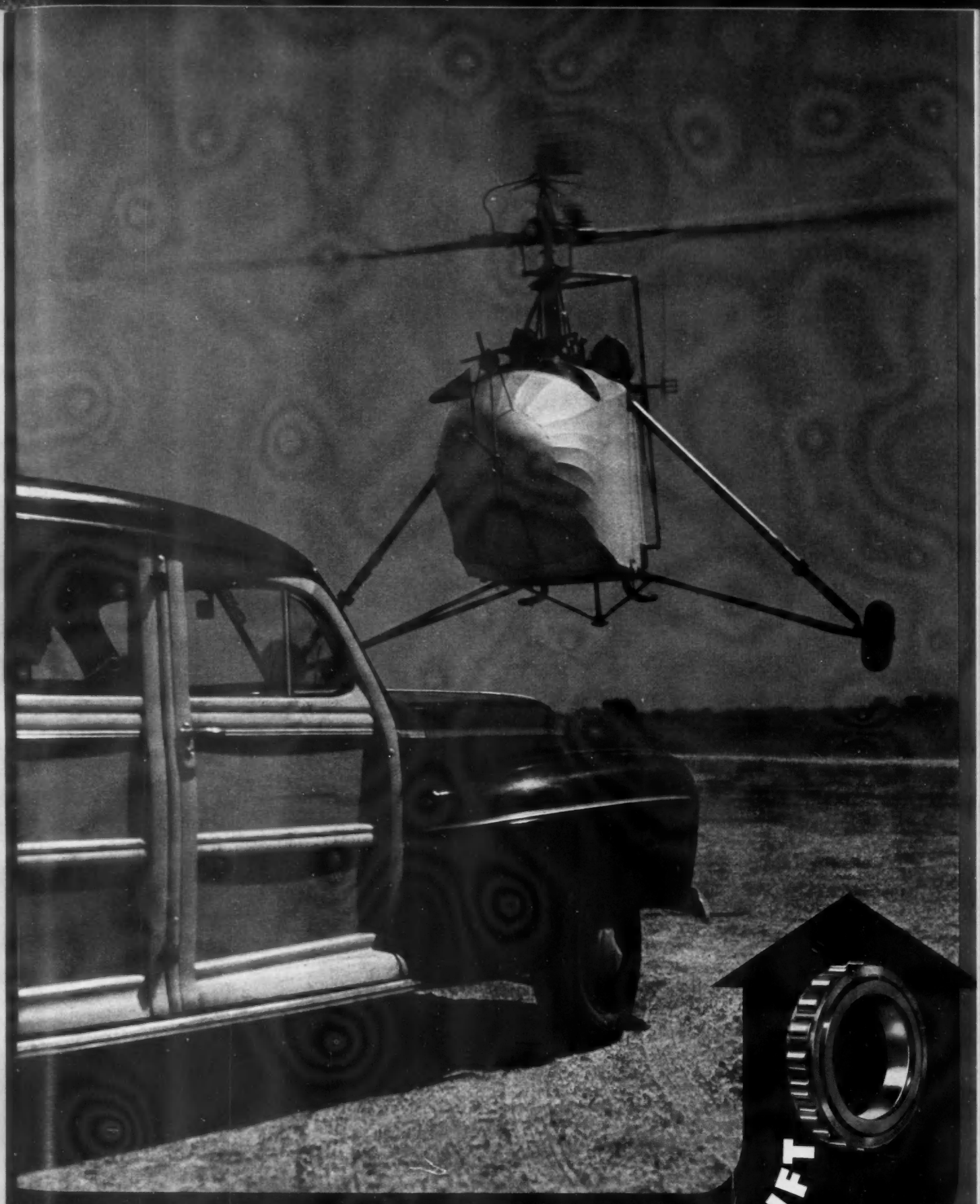
C.W.C. centrifugally cast cylinder liners are metallurgically engineered of electric furnace metal, alloyed or unalloyed. They assure higher resistance to wear and corrosion due to their exceptional qualities of density and uniformity. They combine excellent machinability with high Brinell. C.W.C. liners definitely meet the most exacting requirements of engine builders in every field for equipment or replacement use in either wet or dry applications.

Experienced C.W.C. engineers and metallurgists offer you their counsel concerning the manufacture of cylinder liners or any other cast products. *Casting* is their profession... be sure to take advantage of their experience. Write today!

CAMPBELL, WYANT & CANNON FOUNDRIES

- MUSKEGON, MICHIGAN
  - Henry Street Plant
  - Sanford Street Plant
  - C. W. C. Crankshaft Corp.
- SOUTH HAVEN, MICHIGAN
  - National Motor Castings Co.
- LANSING, MICHIGAN
  - Centrifugal Fusing Co.
- BETTENDORF, IOWA
  - Ordnance Steel Foundry Co.

CAMPBELL, WYANT & CANNON FOUNDRY CO.
MUSKEGON, MICHIGAN



BOWER GIVES THEM A LIFT

Whether in aircraft that flies or ground vehicles that roll, Bower Roller Bearings carry the load with super-smoothness and with dependability not surpassed anywhere in industry.

BOWER ROLLER BEARING CO.
Detroit 14 Michigan

JUST twenty-five years ago this month an idea was born—the idea of an organization dedicated to the development of new and better metal finishing methods and better processing equipment for the application of those methods.

During these years rapid and significant strides have been made in the advancement of metal finishing from the status of a mysterious art to that of a science.

Much of this advancement may be attributed directly to The Udylite Corporation and its farsighted policy of research, service and pioneering. Because of this policy, Udylite has grown during these comparatively few years into one of the largest manufacturers and distributors of metal finishing equipment and supplies.

Today, Udylite with this wealth of "concentrated" experience is ready for the job that lies ahead. The complete Udylite line of fine equipment and tested supplies is known from coast to coast as the best. The Udylite staff of experienced engineers and electrochemists, combined with pilot plant, research and testing laboratory facilities, are a boon and a tradition to the industry.

The liberal Udylite Service Policy is unique, many times copied but never equalled.

Udylite is out ahead to stay, continuing to present improvements and new developments backed by twenty-five years of achievement.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

Udylite

THE UDYLITE CORPORATION
1651 E. GRAND BLVD. · DETROIT

● *Built by* MACK TRUCKS, INC.

Hauling job for a bearing

SKF

BALL AND ROLLER BEARINGS

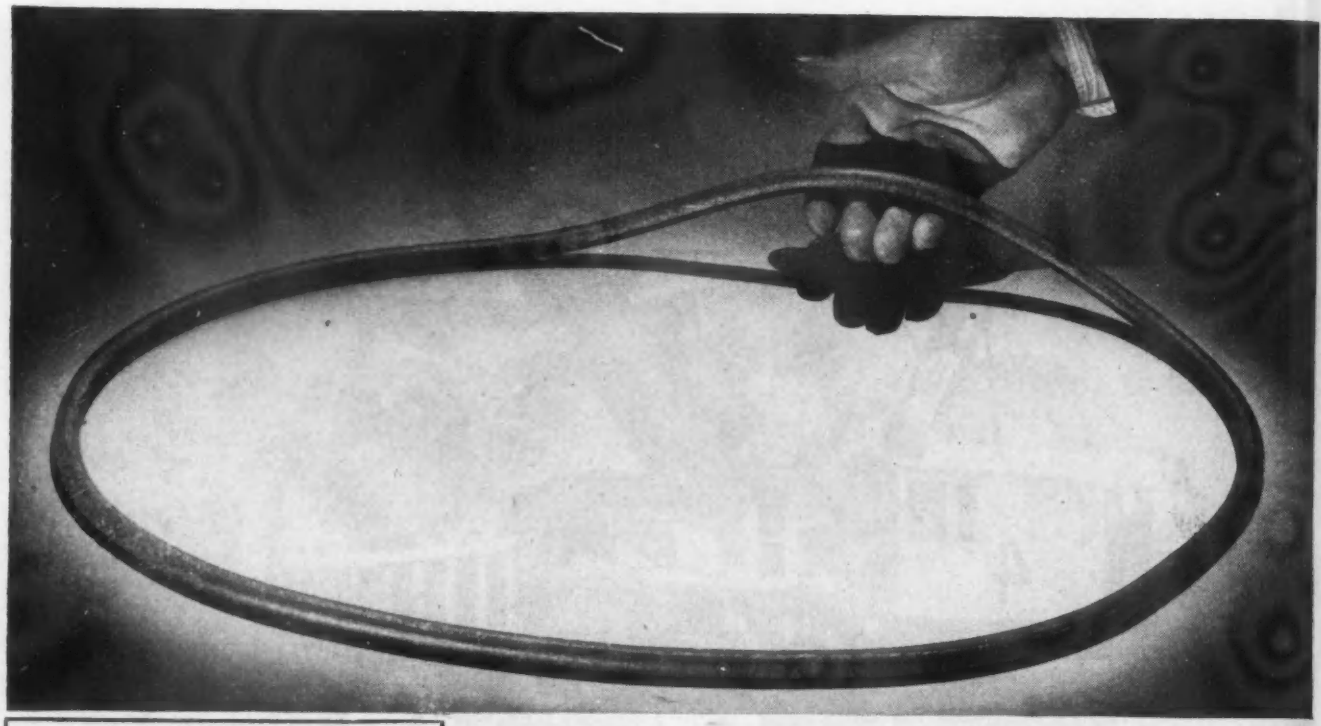
Loaded down with 30 tons of ore, this Mack Model FC six-wheel truck needs the cooperation of every turning part.

That's where SKF Bearings come in.

On the transmission, the engine and other vital parts, SKF's easily carry radial and thrust loads, reduce maintenance costs—speed up the movement of ore to the steel plants.

The more the Automotive Industry helps to win the war, the greater the preference for SKF Bearings. 5649

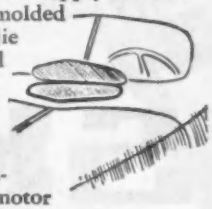
SKF INDUSTRIES, INC. • FRONT ST. & ERIE AVE. • PHILADELPHIA 34, PA.

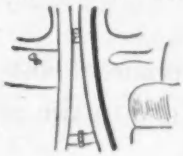


Available NOW!

Cord specially compounded for the Automotive Industry

You may now obtain almost immediate delivery of any quantity of sponge rubber cord (a *cellular rubber* product) for industrial manufacturing. Hundreds of formulas are available – we can control resiliency, tensile strength, pore structure; produce cellular rubber that resists heat, cold, moisture, oils, acids, corrosive vapors, abrasion – supply *continuous* cord, sheets, molded parts, as well as die cut pieces, molded shapes. Millions of cars are already equipped with weatherstripping, arm rests, seat cushions, anti-rattlers, motor mountings, trunk strips, bumpers, window seals, cowl ventilators, and other cellular rubber parts of our manufacture. Our organization, with 21 years experience in this special field, is willing and able to supply your needs now.





The "Rubber Band" that Unloosed a River of Gasoline

War is driving home an old lesson – there are no "unimportant details". Everything counts!

Take the sponge rubber gasket that seals the top of 42 gallon drums of aviation gas for example. A 55-inch circle of gasoline-proof cellular rubber, ½" in diameter. Costs only a few cents. It's expendable.

But because of this gasket drums can be made with removable heads. No more waiting for gasoline to trickle from a bung hole! Drums are emptied twenty times faster!

And shipping is speeded up all along the line. With less waiting time for empties every means of transportation from refinery to advanced air base operates more efficiently. Planes, trucks, ships, trains, make more trips. Fewer drums are needed. Those available can be used more often. Slight dents in rims and lids don't put drums out of service – the sponge rubber compensates for imperfections.

Cellular Rubber May Be Your Answer, Too!

There may be places in your production line where a few cents worth of cellular rubber could be mighty important. Even a tiny pad can dampen vibration, deaden noise, improve efficiency of a machine that costs hundreds or even thousands of dollars.

A cord or molded part can insulate against cold or heat or electric current; seal moisture in or out. Consult us about any problem of sealing, insulating, vibration dampening, sound control. Our technical staff is ready to work with you now.

Sponge Rubber Products Co.

101 Housatonic Avenue, Derby, Conn.

NEW YORK • CHICAGO • WASHINGTON • DETROIT

World's Largest Manufacturer of Cellular Rubber Products

Photo courtesy of Food Machinery Corp.

WHEN the LVT's come rumbling up the beach spitting trouble, when U. S. Army tanks go snarling into battle, when our planes swoop down over enemy lines for some low-level strafing, you can be sure that America's alloy steels are at work.

The list of uses for alloy steels in total war is almost endless. Yet most of the alloys commonly used in fighting equipment today are emergency steels, developed since the outbreak of war. Critical shortages of alloying metals—metals that were once thought indispensable—have failed to halt the war production program. NE grades are making good in jobs that metallurgists once believed could only be filled by the old, established alloys.

A large share of this work of development has been done by Bethlehem metallurgists and engineers. Moreover, at Bethlehem plants, hundreds of exhaustive tests have been conducted to determine precisely the comparative physical properties and the best applications of wartime steels. The results are recorded in a vast amount of data collected during many months of intensive research.

If you have a problem involving analyses, properties, heat treating, or applications of today's steels, Bethlehem metallurgists will gladly make available to you their experience and data. Write today for free copy of Bethlehem's new 100-page book, "Properties of Frequently Used Carbon and Alloy Steels."

BETHLEHEM STEEL COMPANY, Bethlehem, Pa.
BETHLEHEM STEEL EXPORT CORPORATION, New York City

★ ★ ★ BETHLEHEM STEEL ★ ★ ★

PICTURE STORY OF AMERICA'S ONLY MODERN TIRE VALVE

See for yourself why the Jenkins Capless Tire Valve saves tires and trouble for car-owners – makes friends and money for YOU!

1. Until recent years, all tire valves were made with detachable caps. A cap was necessary to maintain correct inflation, otherwise dirt and moisture were apt to creep into the valve stem, loosen the core and let air escape.

2. It went on this way long after high pressure tires had become history. Then Jenkins came out with a modern valve that needed no removable cap . . . a valve designed to give a positive dirt-proof air seal automatically.

3. The Jenkins Capless Tire Valve has no removable core, either. Core is a built-in part of the one-piece valve structure. It gives a plug-type seal – one of the most efficient sealing principles known in valve engineering.

4. This advanced construction is coupled with another exclusive Jenkins principle . . . the truly flexible valve stem. In case of a sudden flat, the flexible stem simply receded through rim hole. No full length metal shank to jam in the hole and rip the tube.

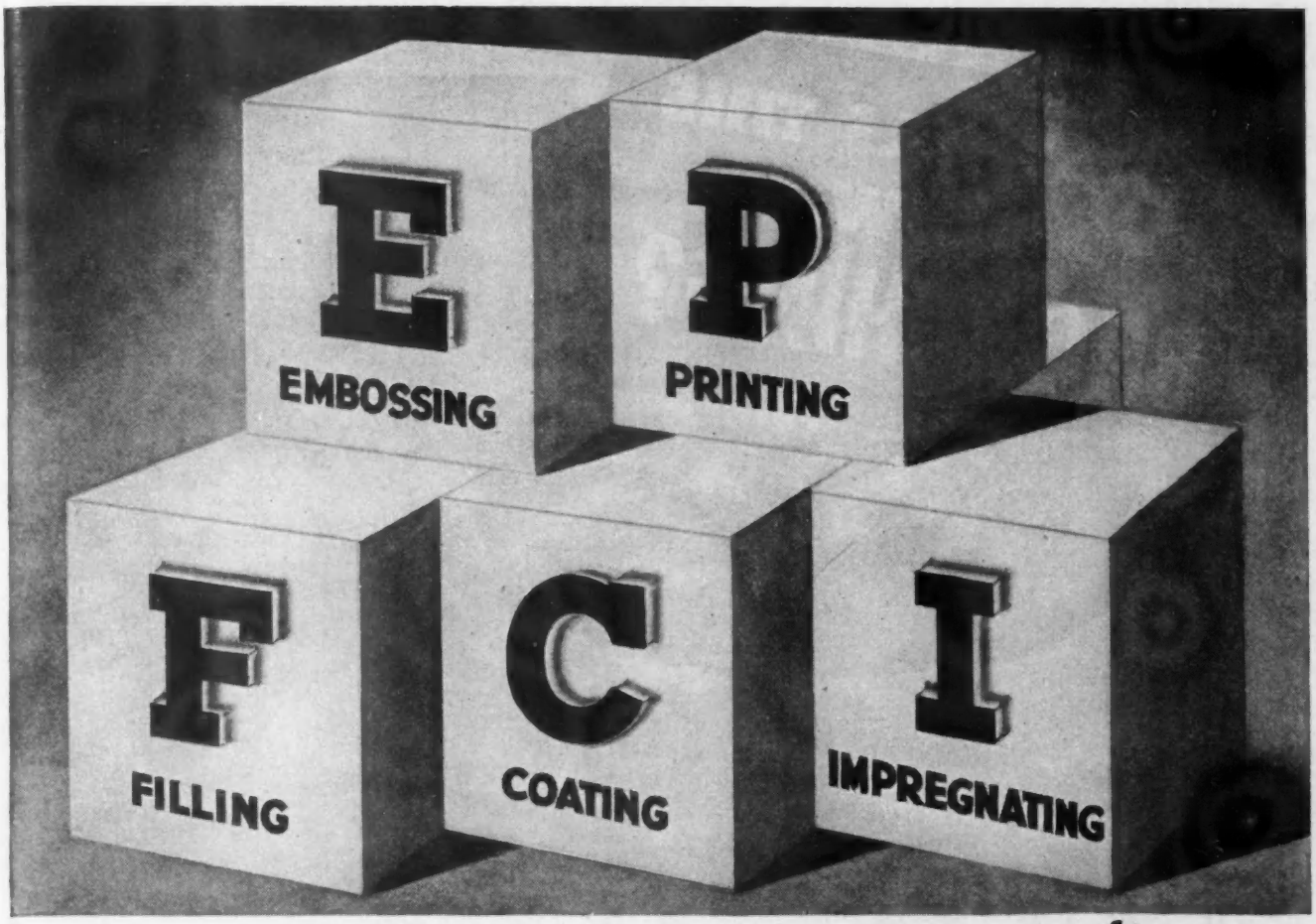
5. Like all tire valves, however, the Jenkins valve takes any standard air-chuck – slip on or screw on – any number of times, without injury to the tip. Proved by countless car owners using millions of tubes equipped with these tire-saving, nuisance-free valves!

P. S. Every Jenkins Capless Tire Valve is GUARANTEED Air-Tight for the life of the tube to which is it originally and properly attached. Men who make or sell tires know the sales-appeal of such a forthright guarantee. For complete data, write Jenkins Bros., Rubber Division, 80 White Street, New York 13, N. Y.

JENKINS *Capless* TIRE VALVE

SEALS AIR IN ▸ ◂ SEALS DIRT OUT

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

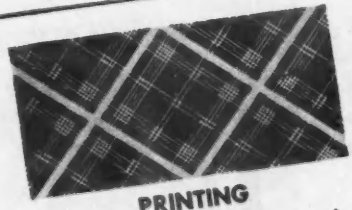


To the basic F-C-I we now add *Printing* to broaden the use field of special finished cloth . . .

Printing means adding to the finished cloth surface a color, design or pattern purely decorative or in which may be combined a trade mark, firm name, pictorial sketch, etc.

Cloth may be surfaced for any printing or lithographing process but as we use the term "printing" we mean running from cloth rolls on a production basis. Some very novel and beautiful printed effects have been produced on cloth for bookbinding. Multiple colors may be used and reasonably accurate register of colors maintained.

As cloth finds new fields of industrial use the possibilities of printing become greater. *Printing* may be definitely regarded as one of the major steps in preparing cloth for specialized uses.



PRINTING

as a cloth finishing process involves the running of the cloth from roll to re-roll at production speeds. Penetrating colors are generally used and the cloth texture is not affected. *Printing* is one of the steps in specialized cloth processing offering many applications and variations to fit special needs.

CURRENT HOLLISTON PRODUCTION includes COATED AND IMPREGNATED FABRICS . . INSULATING CLOTH BASE SEPARATOR CLOTHS rubber, starch-filled, glazed. TRACING AND BLUE PRINT CLOTHS white and blue, ink or pencil. MAP CLOTH, PHOTO CLOTH, self-adhesive. REINFORCING FABRICS. SIGN, LABEL AND TAG CLOTHS, waterproof to take any ink, meet any inking problem. BOOK-BINDING CLOTHS. SHADE CLOTH, impregnated waterproof, opaque, translucent or light proof.

We urge you to consider CLOTH, and invite you to consult with us concerning possibilities and developments for your specific requirements.

The Holliston Mills, Inc.

PROCESSORS OF CLOTHS FOR SPECIAL PURPOSES

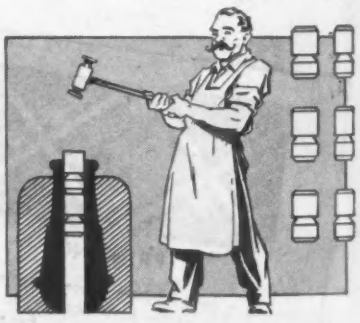
NORWOOD, MASSACHUSETTS

Sales Agents in Principal Cities

WHAT HAS THIS TO DO WITH BROACHING?

SOMEWHERE in the dark of a Celebes moon, a silent shape steals closer, ever closer to the menacing bulk of a Japanese heavy cruiser. Suddenly . . . its mighty engines exploding in a thunderous roar . . . it drives home its lethal load and swerves, madly bucking, to make good its escape. Aiding in its headlong dash for safety, beyond the reach of vengeful guns, is the careful design and construction of its bow sections . . . a modern scientific development of the ancient, fundamental principle of the Wedge, which has served Man in countless usages from the first flint axe to the P. T. boat.

ALSO serving mankind in the scientific adaptions of of fundamental engineering principles, Lapointe has been ever first to combine imagineering with time-proven principles. Broaching is no longer just another method of removing metal. In the hands of those who plan for Tomorrow, broaching has become a powerful weapon in the war of production . . . and in those same hands, will provide revolutionary achievements in the days of peace, by making things quicker — cheaper . . . and better!



The first broaches, or drifts, as they were then called, were driven, one upon another, through the work part.

ARMY E NAVY

The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

THE OLDEST, LARGEST AND LEADING MANUFACTURERS OF BROACHES AND BROACHING MACHINES

Recover COPPER economically by this Du Pont process!

You can electrolytically recover copper plate used as a stop-off in work such as localized hardening. Critical chemicals are eliminated. And you can recover nearly 100% usable metal.

By the Du Pont Deplating Process, deplated copper is recovered in a form satisfactory for reuse as anode material. The process can be carried out rapidly, efficiently, in conventional equipment. The bath is simple—the components are those required for cyanide copper plating. Up to 0.001" of copper can be removed in 15 minutes. And, in contrast to the usual stripping methods, deplating proceeds without attack of the base metal.

Write today for operating instructions on Copper Deplating. It gives all the facts you'll need for fast electrolytic recovery of copper at minimum cost. E. I. du Pont de Nemours & Co. (Inc.), Electroplating Division, Wilmington 98, Delaware.

Great stars in great radio plays make great entertainment . . . tune in "Cavalcade of America"—NBC network—every Monday evening

DU PONT
REG. U. S. PAT. OFF.

DU PONT CHEMICALS • PROCESSES • SERVICE

for ELECTROPLATING

Better Things for Better Living . . . *Through Chemistry*

Surrender

STARTS WITH WAR BOND SALES

Official U. S. Coast Guard photo.

Two members of the shortening Berlin-Tokyo Axis captured fighting side by side in France.

A CONTINUOUS flow of money is the first requisite of a continuous flow of manpower and matériel to the fighting fronts.

Money, raised in continuous War Bond sales, makes it possible to attack—to attack unceasingly until the Axis is forced into total, unconditional surrender!

Retailers of America, our armed forces expect you to help make them the best trained, best equipped, best cared for fighters on land, sea and air. They want to finish the fighting at the earliest possible moment. They want to get home to the jobs that you will have helped to provide through built-up post-war purchasing power—*by selling more War Bonds than before!*

War Bond selling is your part of the job of bringing about the Axis' unconditional surrender. Keep working at it. Drive your War Bond sales to an all-time high. Then drive them higher! higher!! higher!!!

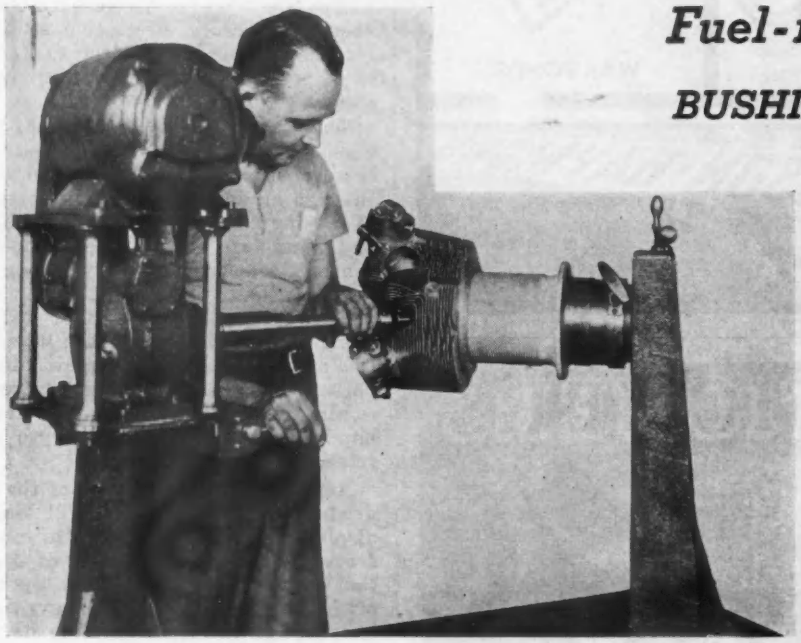
Back the Attack!
SELL MORE THAN BEFORE!

The Treasury Department acknowledges with appreciation the publication of this message

This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council

Simple,—isn't it?—

—compared to unwieldy tools or manual labor in TIGHTENING Fuel-injection BUSHINGS . . .



THE Correct TORQUE ...automatically!

There's a ***Scandia*** *Torque Machine*—*

—compact, simple and with absolute control of torque, to do the back-breaking or arm-straining work heretofore done with unwieldy, mammoth wrenches or other tools, none of which did more than "guess" at the proper torque. These Scandia Torque units are for seating bushings (gas-tight) or driving the smallest studs or the largest engine-bolts.

Ask for interesting details,— and Savings assured!

* Manufactured under Bronander Patents.

Scandia MANUFACTURING CO.

NORTH ARLINGTON NEW JERSEY

On the Job in Every Department

A well-rounded service to give spring action in all its forms—with design and research facilities—latest types of heat-treatment—for durable, uniform springs.

COMPRESSION SPRINGS

FLAT SPRINGS and Small Stampings, too

WIRE FORMS

TORSION SPRINGS

EXTENSION SPRINGS

Spring Washers | Die Springs | Snap Rings

WAR BONDS

ARMY
NAVY
Springs · Wire Forms · Small Stampings
BARNES·GIBSON·RAYMOND
TWO PLANTS FOR SPRING SERVICE
DETROIT and ANN ARBOR MICHIGAN
B-G-R PRODUCTS SERVE OUR COUNTRY ON LAND, AT SEA, AND IN THE AIR

C-F POSITIONERS

In Any Welding Operation It's "Position" That Counts

Production welding usually means working on top, bottom and on all sides of the weldment. It means a "quick change" of position should be possible for greater time saving, more efficiency, lower costs and greater safety to men and materials. With C-F positioners a welder can quickly position even the most cumbersome weldments at the press of a button, without crane help or handling crews. With just one set-up of the weldment, he can position it easily, speedily and safely, all alone. He can rotate it a full 360° at variable speeds from 0 R.P.M. up, tilt it to 135° beyond horizontal, and can weld, downhand, all sides, surfaces and angles in the one set-up with larger rods and fewer passes. All C-F positioners, both stationary and portable, are pedestal mountdd to give maximum floor and working clearance and all are adjustable for height.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO.

1322 S. Kilbourn Ave. Chicago 23, Ill.

Stabilizer System

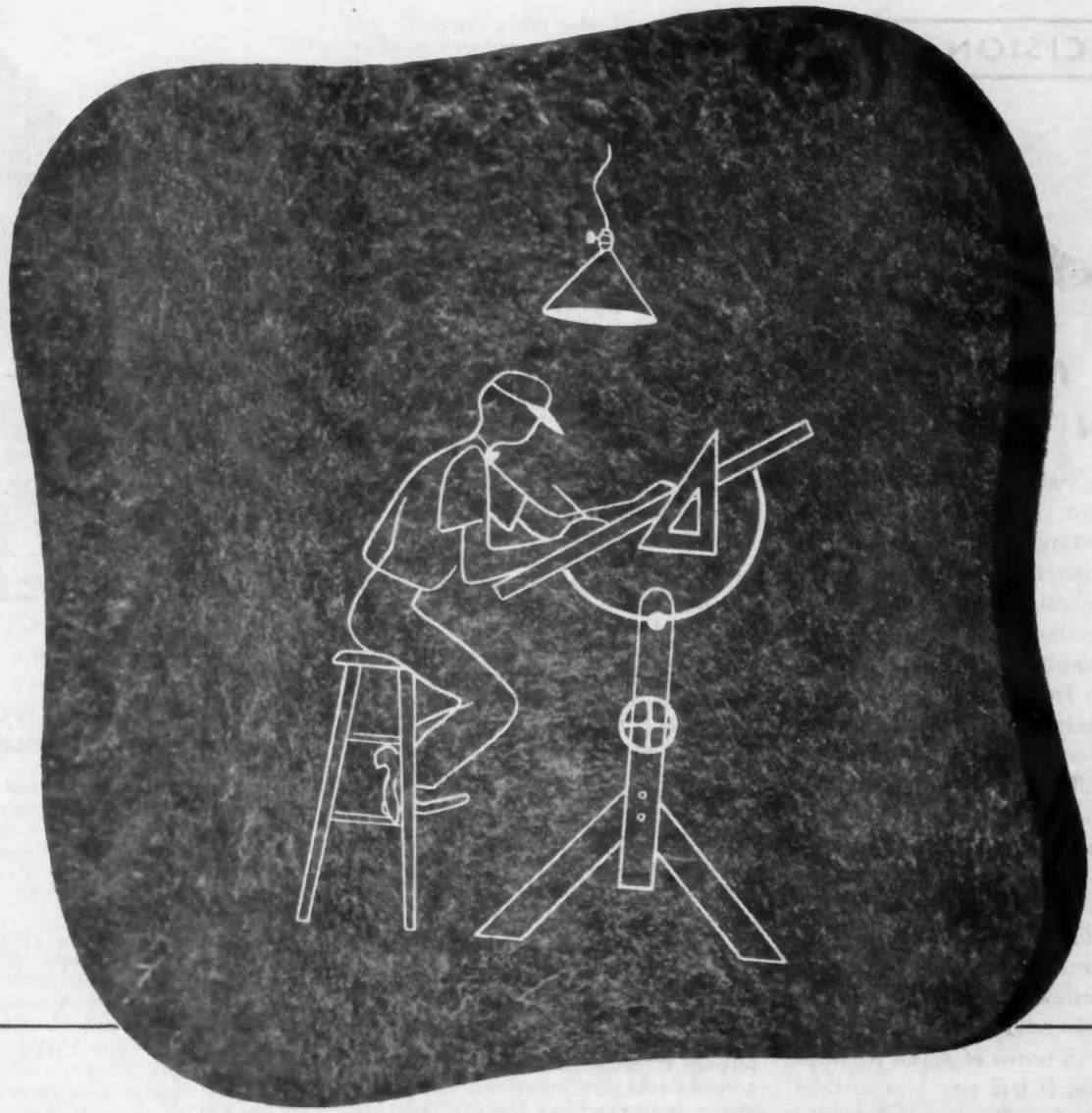
(*Continued from page* 32)

gyro which controls the silverstats through its response to angular velocity and through its slight gravity response. The gravity response is effected by an offside unbalanced weight which causes a slight deflection of the silverstats in the proper sense whenever the gyro is tilted from vertical, and a gradual return to vertical occurs. Attached to a bracket on the motor, a Micarta spacer opens and closes the silverstat contacts as the gyro moves on its precession bearings. The silverstat has two sets of 10 leaves which connect to taps on resistors. The current through the magnetic coils on the oil pump valves can thus be regulated by making and breaking silverstat contacts. The bellows assembly is attached to the gyro control base and is connected to the gyro with piano wire. It hydraulically damps the gyro to prevent resonance about the vertical precession axis and returns the Micarta spacer to its correct position between the silverstat leaves.

The gyro has only one degree of freedom about a vertical axis and precesses against a spring centering through an angle which is proportional to the angular velocity of the gun about its trunnions. Since the mono-gyro control does not have very strong absolute vertical reference, the gun may not always return to its exact starting point when it is disturbed. However, this apparent lack of accuracy is unimportant because the gunner is required to aim the gun continuously anyway by handwheel rotation of the gyro unit relative to the gun.

Any angular displacement of the gun arising from tank motion will tend to displace the gun-mounted gyro control from its position. The cycle of operation is shown in Fig. 2. When the tank pitches or vibrates (1) the gyro control is slightly displaced from its former vertical position, (2) the resulting precession of the gyro makes electrical contacts, shorting resistances through the silverstat, (3) the changed current alters the two electro-magnets regulating the teeter valves, (4) the operation of the oil valves decreases the pressure on one side of the hydraulic piston and increases the pressure on the other side, (5) the piston is forced toward the low pressure side, and (6) the movement of the gun is controlled accordingly since the piston is fixed to the gun.

The recoil of the gun barrel after firing results in large gravity unbalances. To prevent the violent disturbances which this would cause, an auxiliary control is provided; a microswitch closes when the gun recoils and furnishes current to an auxiliary magnet recoil of the valve in a manner to supply supporting pressure for breech heaviness during recoil. The recoil adjustment need not be precise because the gyro control through its silverstat



One way to avoid Post-War PANNING

. . . Investigate Felters Felt For Your Products

All indications point to the fact that Felters Felt will play an *even greater role* in the post-war world. For, in addition to all the advantages that this material offers in its own right, it also substitutes perfectly for rubber and cork.

Felters Felts offer you a wide range of resiliences and can be cut to any shape without fraying. They are strong, long-lived, unaffected by normal atmospheric conditions, moisture, sun, heat and cold. They have good acoustical properties and make excellent vibration isolating mediums.

To help *you* in your designing of post-war products the services of the Felters Engineering Department and Laboratory are at your disposal. We will also be glad to send you timely engineering bulletins and other helpful literature relating to felt. Write—without obligation on your part.

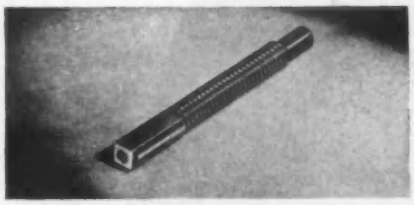
ARMY E NAVY

THE Felters Company

210-R SOUTH STREET • BOSTON, MASSACHUSETTS

Offices: New York, Philadelphia, Chicago, Detroit • Sales Representatives: Dallas, Los Angeles, Nashville, St. Louis, St. Paul • Mills: Johnson City, New York; Millbury, Massachusetts; Jackson, Michigan

PRECISION PARTS



ACE MACHINING ON THE BEAM

This is a vital part of an air-borne instrument. Its beam picks out a bomber's target below the clouds. It helps bring the crew home safely after the mission. It helps avoid mid-air collisions.

Ace manufactures these parts complete from stainless-steel bar-stock. Each piece is roughed out on a screw-machine and then the square milled on the end. It is then cylindrically ground and the flats are surface-ground. After completing these operations, the threads are ground from the solid blank.

Working with close tolerances on a mass-production basis is an Ace accomplishment that offers many worthwhile advantages. If you are thinking in terms of small parts or assemblies, it will pay you to consult with Ace. Send sample blueprint or sketch for quotation.

ACE
TRADE MARK

ACE MANUFACTURING CORPORATION
for Precision Parts

1241 E. ERIE AVENUE,
PHILADELPHIA 24, PA.

A Complete Service Under One Roof

Whether your job requires machining, grinding, or stamping . . . and whether it involves drilling, threading, or hardening . . . Ace is set-up to handle each operation. Responsibility at Ace is not divided. Time at Ace is not wasted.

regulation of the other magnet coils compensates for any remaining differences.

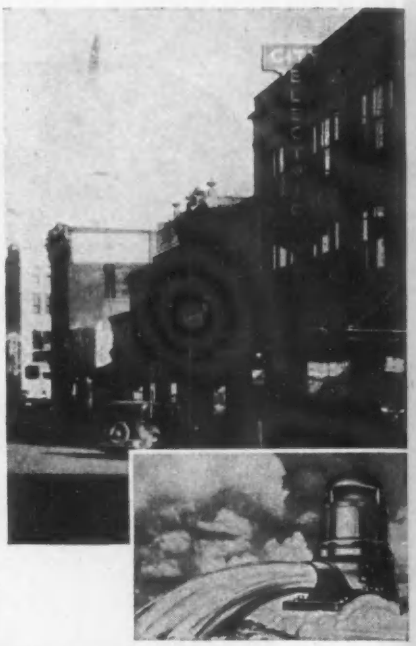
Actually, power aiming is obtained in the same simple manner and through the same controls that causes stabilization. The gyro unit is so attached to the gun that it may be rotated by means of a handwheel, flexible shaft, and worm gear. The rate of turning the handwheel affects the gyro member just as angular velocity of the gun; the gunner aims the gun by precessing the gyro in accordance with his rate of turning and the stabilizer tends to maintain the gun in its aimed position. And very slow drifting caused by lack of a strong absolute vertical reference is thus readily compensated by the gunner himself.

In the development of the stabilizer, it was found that the principal disturbances average 1½ cycles per second corresponding to the pitching frequency of the tank on its springs, while angular velocities are about 30 deg per sec and accelerations about 300 deg per sec^2. The Ordnance Department had requested that disturbances of ± 2½ deg at 1½ cycles per sec for the tank, typical fluctuations over average rough terrain, should be reduced to ± 1/3 deg error at the gun. The stabilizer as developed exceeded these specifications by about 3 to 1, i.e., disturbances of ± 2½ deg at 1½ cycles per sec result in less than ± ⅙ deg gun eror instead of the specified ± 1/3 deg.

Servo Mechanism System

A power means is used for stabilizing the tank gun rather than a gyroscope large enough to resist the disturbing torques directly. Because the required accelerations are excessive, an electric motor is impractical for this purpose. High angular accelerations can be obtained with an electric motor drive, but the unit would be too large for the limited, available turret space.

The servo mechanism in use is a composite electro-hydraulic system having two constant displacement pumps, one for each end of the hydraulic cylinder. The pressure difference for the pumps is controlled by a pair of seated by-pass valves regulated by the teeter bar armature of an electro-magnetic unit. The entire assembly, including the magnetic valve-control device is oil-immersed. The double pump utilizes three spur gears running at constant speed. The discharge from each pump normally passes through one of the seated valves. If, however, a valve is partially closed by a differential pull of the magnet coil, the pressure increases, forcing oil into the cylinder supplied by that pump. Since the magnet valve is encased within the sump of the hydraulic system, the operation is free of friction. Furthermore, since a very small movement of the valves immediately provides any proportion of the constant flow from the pumps, the operation of the system is instantaneous for all practical purposes.



"Main Street" IS GOING TO SEE A LOT OF CHANGES

Every City Official, Engineer and Plant and Factory superintendent had better be ready and willing to go along in a lot of new changes for the active days of postwar. Your America is going to be a pretty alive and progressive country. Things are going to happen very rapidly.

There is one mighty big and important fact that all should remember: . . . all progress, growth and development will absolutely depend upon an adequate and thoroughly dependable supply of water.

As after World War I, Layne is now swinging over to industrial and municipal Well Water System installation work. The requirements for peace time need are now being given special attention. The building of Layne high efficiency pumps is continuing without let up. Field testing and drill crews are up to full strength. Ready now are all kinds of parts, supplies and new equipment for the enlarging or the reconditioning of old wells. All branches of Layne service are ready to serve on important Water Supply work.

If your needs are for more water, or if your present system needs service, better get in touch with Layne without delay. For late literature, catalogs, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minnesota, Minneapolis, Minn. ★ International Water Supply Ltd., London, Ontario, Canada

LAYNE

WELL WATER SYSTEMS
DEEP WELL PUMPS

BUILDERS OF WELL WATER SYSTEMS FOR INDUSTRIES AND MUNICIPALITIES

STANDARD GLASS-RUN WINDOW CHANNEL

The Standard Products Company, world's largest manufacturer of Glass-Run Window Channel, has available for immediate delivery complete stocks of window channel, bat wings and contour weather strip for replacement service. These products are for use in passenger cars, truck cabs, busses, taxicabs, trailers, motor boats, airplane cabins and streamlined trains.

Standard Glass-Run Window Channel is constructed with a rubber-covered steel cord, durable woven fabric lining and exposed edges. Full felt bottom for curved or straight windows. Requires no attachments. Rubber-covered back eliminates noise and rattles. Special designs—our laboratory and engineering departments are equipped to design and produce Glass-Run Window Channel for special jobs. Forward necessary details and our engineers will submit designs and proposal.

THE STANDARD PRODUCTS CO.

Main Offices and Research Laboratory

505 BOULEVARD BUILDING DETROIT 2, MICHIGAN

★ ★ ★

Automobile manufacturers are invited to inquire into the plastic molding facilities offered to them by the Plastic Division of The Standard Products Company. Parts molded from thermo-plastic and thermo-setting plastic materials of all types.

PROTECTS

The tough, resilient, coiled rawhide faces of C/R Hammers and Mallets strike effective blows without battering or marring... protects finished surfaces, machines delicate insulation and parts. Speed die-setting, assembly, no fatiguing re-coil. Reduce breakage and spoilage. Sizes and weights for every need.

C/R Hammers have permanent malleable iron heads which take replaceable insert faces of mechanical rawhide.

CHICAGO Rawhide MFG. CO.
1310 ELSTON AVE. ★ CHICAGO, ILLINOIS.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of AUTOMOTIVE and Aviation INDUSTRIES, published semi-monthly at Philadelphia 39, Pa., for October 1, 1944.

State of Pennsylvania } ss.
County of Philadelphia }

Before me, a notary public in and for the State and county aforesaid, personally appeared Jos. S. Hildreth, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the AUTOMOTIVE and Aviation INDUSTRIES and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Chilton Company, Chestnut and 56th Sts., Philadelphia 39, Pa.; Editor, Julian Chase, 5601 Chestnut Street, Philadelphia 39, Pa.; Managing Editor, None; Business Manager, Joseph S. Hildreth, York Lynne Manor Apts., City Line and Berwick Rd., Overbrook, Philadelphia 31, Pa.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well, as those of each individual member, must be given.) Chilton Company, Chestnut and 56th Sts., Philadelphia 39, Pa.

Holders of more than 1% of the capital stock outstanding of Chilton Company: C. A. Musselman, 260 Sycamore Ave., Merion Station, Pa.; J. S. Hildreth, York Lynne Manor Apts., City Line and Berwick Road, Overbrook, Philadelphia, Pa.; Charlotte M. Terhune, 160 E. 48th St., New York, N. Y.; John Blair Moffett, Fishers Rd., Bryn Mawr, Pa.; C. S. Baur, 69-11 Yellowstone Blvd., Forest Hills, L. I., N. Y.; J. H. Van Deventer, 270 West End Ave., New York, N. Y.; Mrs. Beulah Fahrendorf, 19 Tunstall Rd., Scarsdale, N. Y.; Mary M. Acton, 260 Sycamore Ave., Merion Station, Pa.; Mabel M. Musselman, 260 Sycamore Ave., Merion Station, Pa.; Dorothy S. Johnson, 1115 Fifth Ave., New York, N. Y.; Ann E. Tomlinson, c/o Bankers Trust Company, P. O. Box 704 Church Street Annex, New York, N. Y.; Ethel G. Breen, Trustee u/w of Charles W. Anderson, Old Greenwich, Conn. —Beneficiaries: Robert C. Anderson, Percival E. Anderson, Charles W. Anderson, Jr., Annie L. Clark; John Blair Moffett, 1608 Walnut St., Philadelphia, Pa.—Agent for J. Howard Pew, J. N. Pew, Jr., Mabel P. Myrin, Mary Ethel Pew; Elizabeth J. Bailey and Ellwood B. Chapman, Trustees Estate of James Artman, Deceased, 930 Real Estate Trust Building, Philadelphia, Pa.—Beneficiaries: Franklin Artman, Vera Watters, Alvin C. Artman, Elizabeth J. Artman, Marion A. Pratt, George H. Pratt, by assignment, Edwin Moll, by assignment; Frederick S. Sly, 149-40 35th Ave., Flushing, L. I., N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is . (This information is required from daily publications only.)

JOS. S. HILDRETH, *Pres. & Business Manager.*

Sworn to and subscribed before me this 20th day of September, 1944.

BESSIE F. HAMMOND

(My commission expires January 7, 1945.)

[SEAL.]

Aeronautic Meeting

(*Continued from page* 94)

pellers, is dependent on the amount of braking system required to satisfy the following two requirements: (1) Provide sufficient braking system to make two landings relying on wheel brakes alone; (2) Provide enough brake system to taxi satisfactorily without excessive brake maintenance.

Based on recent data obtained in connection with the design of large aircraft, it is felt that approximately 50 per cent of the weight of existing brake systems can be eliminated if only the two previously mentioned requirements are to be met. On this basis, the potential weight saving for an airplane of 50,000 lb gross weight is about 200 lb, for a 100,000-lb plane about 400 lb, and for a 150,000-lb plane about 850 lb.

These weight savings are believed to be obtainable since satisfactory normal landings can be made with reverse thrust alone, or if desired, with reverse thrust supplemented by wheel braking after the airplane has decelerated to approximately 40 mph. In such a manner the amount of work done by the brakes would at most be only approximately 20 per cent of that required for a landing in which the brakes alone were used.

In subsequent issues abstracts of other papers will be printed.

DO YOU USE WIRE CLOTH
STRAINERS?

Michigan Wire Cloth Company can assist you in the development of the proper strainer design.

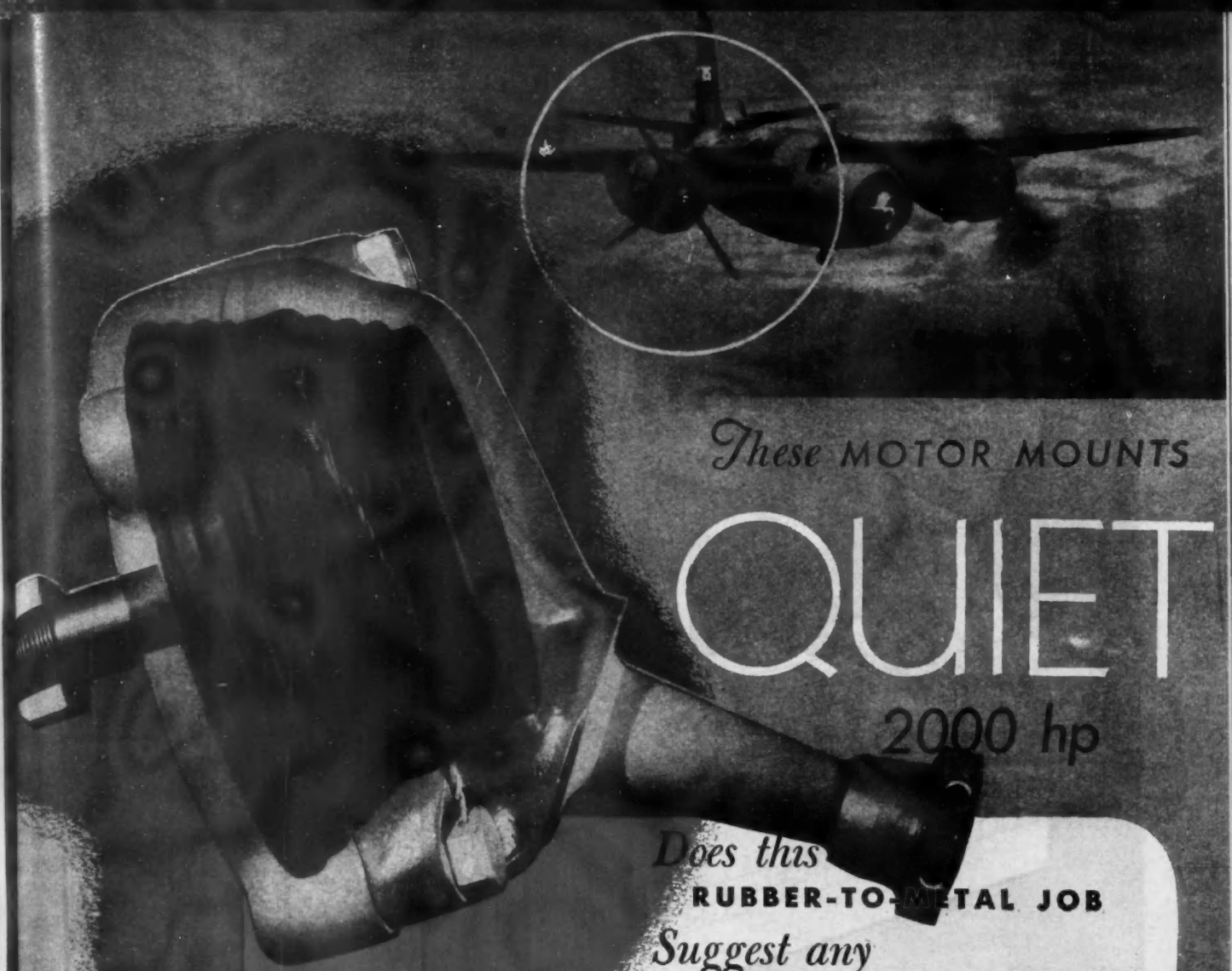
Complete manufacturing facilities for drawing the wire • weaving the cloth • and fabricating the assembly . . all by one organization.

Send Michigan Your Inquiries

Established 1860

MICHIGAN WIRE CLOTH CO.

2100 HOWARD • DETROIT 16



These MOTOR MOUNTS

QUIET

2000 hp

Does this

RUBBER-TO-METAL JOB

Suggest any

NEW APPLICATION?

Take thousands of terrific explosions per minute in the greatest power plant ever devised . . . add the sudden stresses of pulling out of power dives—the twists of combat maneuvers, the strains of holding a dead engine . . . and you get some idea of the world's number one vibration dampening job.

This problem is licked on many planes today by the motor mount shown above. Our work is a contribution to the engineering of the core assembly; a series of steel plates bonded together and to the core by rubber in such a way that it passes all Air Corps tests for adhesion and shear rate.

This example suggests our ability to handle rubber-to-metal adhesion and may indicate to you new applications for postwar products. We will be glad to place our engineers and laboratory at your disposal.

Write for the IDEA chart and suggestion blank.

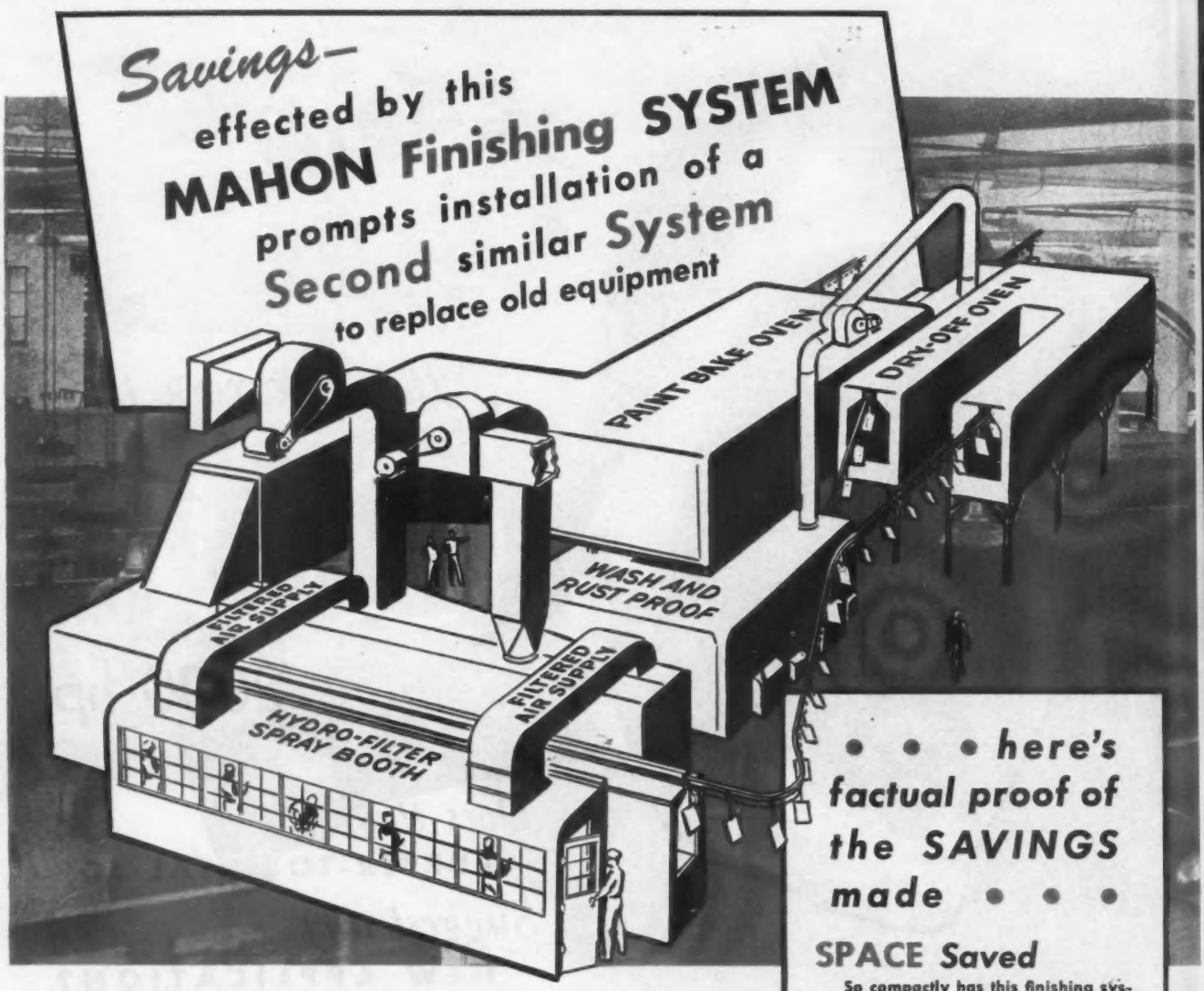
Also

Precision Molders of many other parts of synthetic soft rubber to meet close specifications now called for by the Air Corps.

THE CONNECTICUT HARD RUBBER CO.

493 EAST STREET, NEW HAVEN, CONN.

Custom Rubber Molders Since 1920



A finer, better product—*faster*

Back in 1940, one of the larger Eastern manufacturers installed a MAHON Finishing SYSTEM to augment finishing equipment already set up. Then came the speed-up of war production—presenting an unusual opportunity to compare the operational cost and productivity of the old and new systems, handling approximately the same work. So great have been the savings effected by the Mahon System over the old equipment, the management has decided to replace this old equipment with a second new and modern finishing system, designed, built and installed by Mahon. Work is now in progress and the new system soon will be in operation—assuring still further reduction in finishing costs, both on present and on future peacetime products.

Mahon engineers will be glad to give you the story in detail—and accord you fullest cooperation in working out a solution to YOUR finishing problems.

• • • here's factual proof of the SAVINGS made • • •

SPACE Saved

So compactly has this finishing system been engineered, it occupies considerably less area than the old equipment—conserving greatly on floor space.

TIME Saved

Continuous conveyor production, throughout, disposes of needless repeated handling and the possibility of damage to product. Important reduction in cost and time results.

MANPOWER Saved

With the exception of spray painting operations, the system is almost entirely automatic. Men, formerly required, now are released for other essential work.

THE R. C. MAHON COMPANY

DETROIT 11 — CHICAGO 4

Manufacturers of Metal Cleaning Machines • Rust Proofing Machines • Hydro-Filter Spray Booths • Ovens of All Types • Filtered Air Supply Units • Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems

YOU'LL find an important part of the answer in *rural America* . . . and the towns and small industry that are a part of the warp and woof of it!

There you'll find the fertile soil that will nourish the enormous purchasing power America must have to make our soldiers' ambitions come true.

All America . . . and American Industry in particular . . . has a stake in its continued well being.

Does this mean that sub-contracting so vital to the accomplishment of the miracle of American War Production is to be a factor of Post-War Production?

Will sub-contracting result not only in spreading the purchasing power but in providing a more efficient manufacturing procedure which in turn will make available more and better goods to more people?

As sub-contractors . . . as an organization located in one of America's smaller communities in the heart of the Middle West . . . to us, the answer is plain.

It is YES.

And while we of American Industry are now putting plans into action to make the miracle of post-war production come true . . . let us redouble our efforts in support of War Bond Sales whose essentiality for financing the war and providing an important base for post-war purchasing power is recognized by all of us.

★

This message is published in the interest of War Bond Sales and a prosperous post-war America of Free Enterprise by Burgess-Norton Mfg. Co., the services of whose Engineering staff, Metallurgical and Research Laboratories are available now to the manufacturers who will require piston pins, screw machine parts, heat treated and ground steel products, hydrogen copper brazing, non-precision ball bearings and related fabricated steel products.

Burgess Norton
MANUFACTURING COMPANY
40 years in GENEVA, ILLINOIS

A Part is Never Made Right unless it is Satisfactory to Our Customers

They mold them BIGGER and BIGGER with LUMARITH*

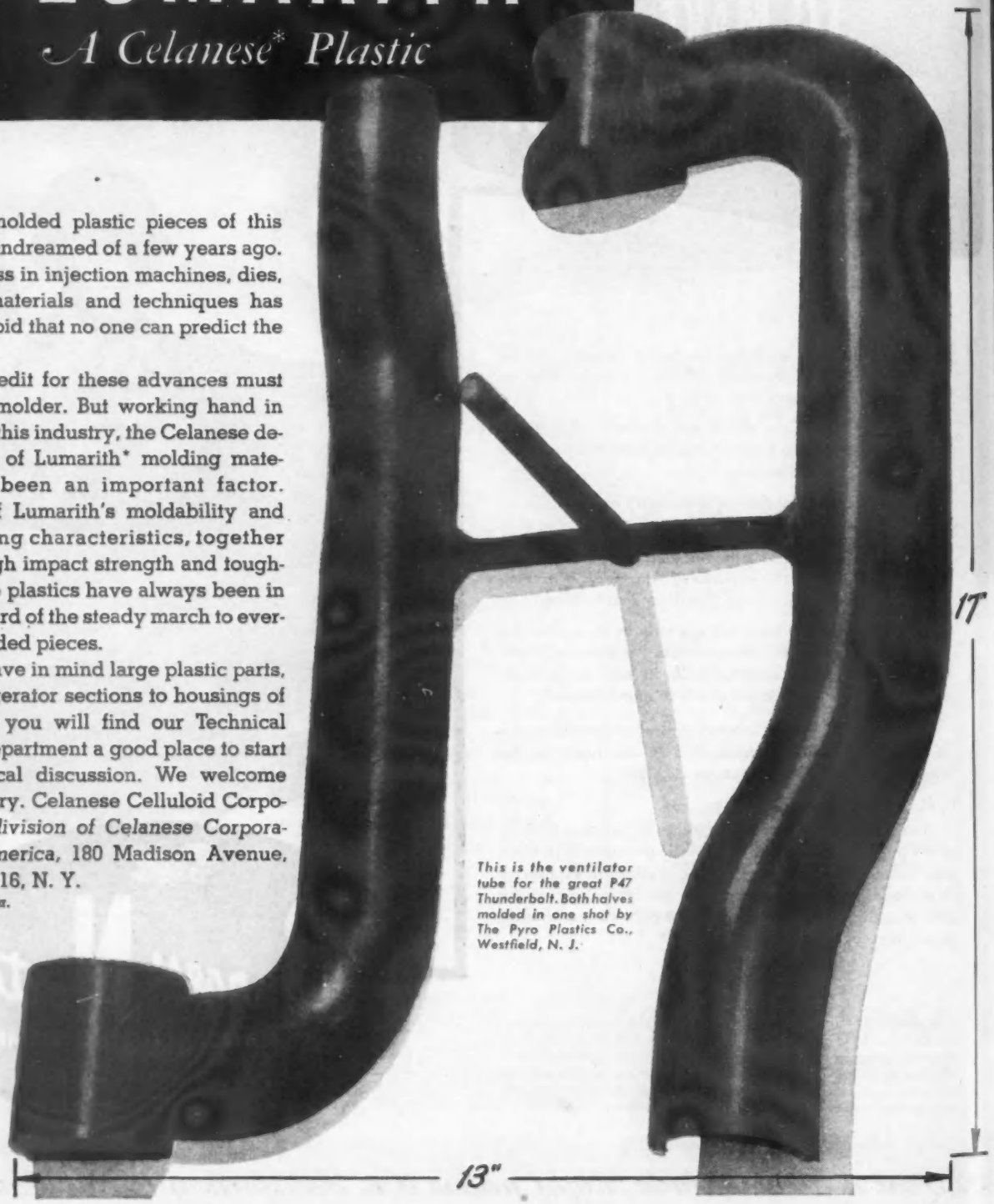
A Celanese Plastic*

Injection molded plastic pieces of this size were undreamed of a few years ago. But progress in injection machines, dies, molding materials and techniques has been so rapid that no one can predict the limit.

Much credit for these advances must go to the molder. But working hand in hand with this industry, the Celanese development of Lumarith* molding materials has been an important factor. Because of Lumarith's moldability and free-flowing characteristics, together with its high impact strength and toughness, these plastics have always been in the vanguard of the steady march to ever-larger molded pieces.

If you have in mind large plastic parts, from refrigerator sections to housings of any type, you will find our Technical Service Department a good place to start the practical discussion. We welcome your inquiry. Celanese Celluloid Corporation, a *division of Celanese Corporation of America*, 180 Madison Avenue, New York 16, N. Y.

*Reg. U. S. Pat. Off.



This is the ventilator tube for the great P47 Thunderbolt. Both halves molded in one shot by The Pyro Plastics Co., Westfield, N. J.

American Brakeblok

BRAKE LINING

"Insures safety... builds goodwill"

– says Stopper

AMERICAN BRAKEBLOK DIVISION
DETROIT 9, MICHIGAN

DIVISION OF
AMERICAN Brake Shoe COMPANY

Master stocks in 38 NAPA warehouses. Jobbers everywhere give prompt service.

BULLDOG WILL SPEED RECONVERSION

All industry, during the war, has learned that good lighting pays for itself many times over — in bigger output, better work, less spoilage, and employee health.

Plants equipped with BullDog Universal Trol-E-Duct will find its advantages multiplied in the reconversion period, and in the peacetime competitive race to come.

It is the only system that provides completely flexible lighting. It brings lights close to the work — permits you to add new lights or re-locate present ones, instantly and wherever needed.

Expert BullDog engineers are ready to help you now in your postwar preparation. Write for information about BullDog Universal Trol-E-Duct and its companion systems — BUStribution DUCT for flexible power and Industrial Trol-E-Duct for portable tools, cranes, hoists and other moving loads.

Any type of light can be suspended from Universal-Trol-E-Duct — the Duct serving as both support and feed. Trolleys or Plugs inserted in the Duct convey current from the Duct to the lighting fixtures.

ALSO MANUFACTURERS OF
VACU-BREAK SAFETY SWITCHES • SWITCHBOARDS • SAFTOFUSE PANEL BOARDS • CIRCUIT MASTER BREAKERS • UNIVERSAL TROL-E-DUCT • INDUSTRIAL TROL-E-DUCT.

BULLDOG
ELECTRIC PRODUCTS CO.
BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

Engineered TO THE JOB!

CLARK FORK TRUCKS ARE SPECIALIZED EQUIPMENT... DEVELOPED TO HANDLE MATERIALS

Faster— more efficiently at lower cost

Start now!

Convert unskilled labor into skilled labor—for America's industrial future must be founded on a Nation of highly skilled workers making precision quality products on a mass-production scale.

"Unskilled labor adds nothing to a product except cost."

CLARK TRUCTRACTOR

BATTLE CREEK, MICHIGAN, U.S.A.

Another PRODUCT of CLARK EQUIPMENT COMPANY

Products of CLARK • INDUSTRIAL TRUCKS AND TRACTORS • BOOSTER UNITS • EASY ROLL TRAILER AXLES AXLES FOR TRUCKS AND BUSES • GEARS AND FORGINGS • ELECTRIC STEEL CASTINGS • METAL SPOKE WHEELS TRANSMISSIONS • AXLE HOUSINGS • RAILWAY TRUCKS • BLIND RIVETS • HIGH-SPEED DRILLS AND REAMERS

THE return from war to peace production by *Sprayit* and *Elsco* will be News... *Headlines* will be made when our post-war products are announced.

These new and improved products will be the finest ever offered...They will have new and more appealing appearance...They will have increased efficiency...They will be manufactured from the finest basic materials, by highly skilled hands, in a most modern, mass production plant...They will have value beyond anything yet available.

Sprayit will offer an outstanding new line of spraying equipment, air compressors, spray guns, insecticide sprayers, air tools, sanders, and allied finishing equipment.

Elsco will produce a fine line of electric motors, generators, hydraulic cylinders, valves, pumps and controls for aircraft, automotive and other industrial applications.

Civilian production wheels will be set in motion just as soon as present restrictions permit. Meantime, our organization, while working for war, prepares for peace.

ARMY (E) NAVY

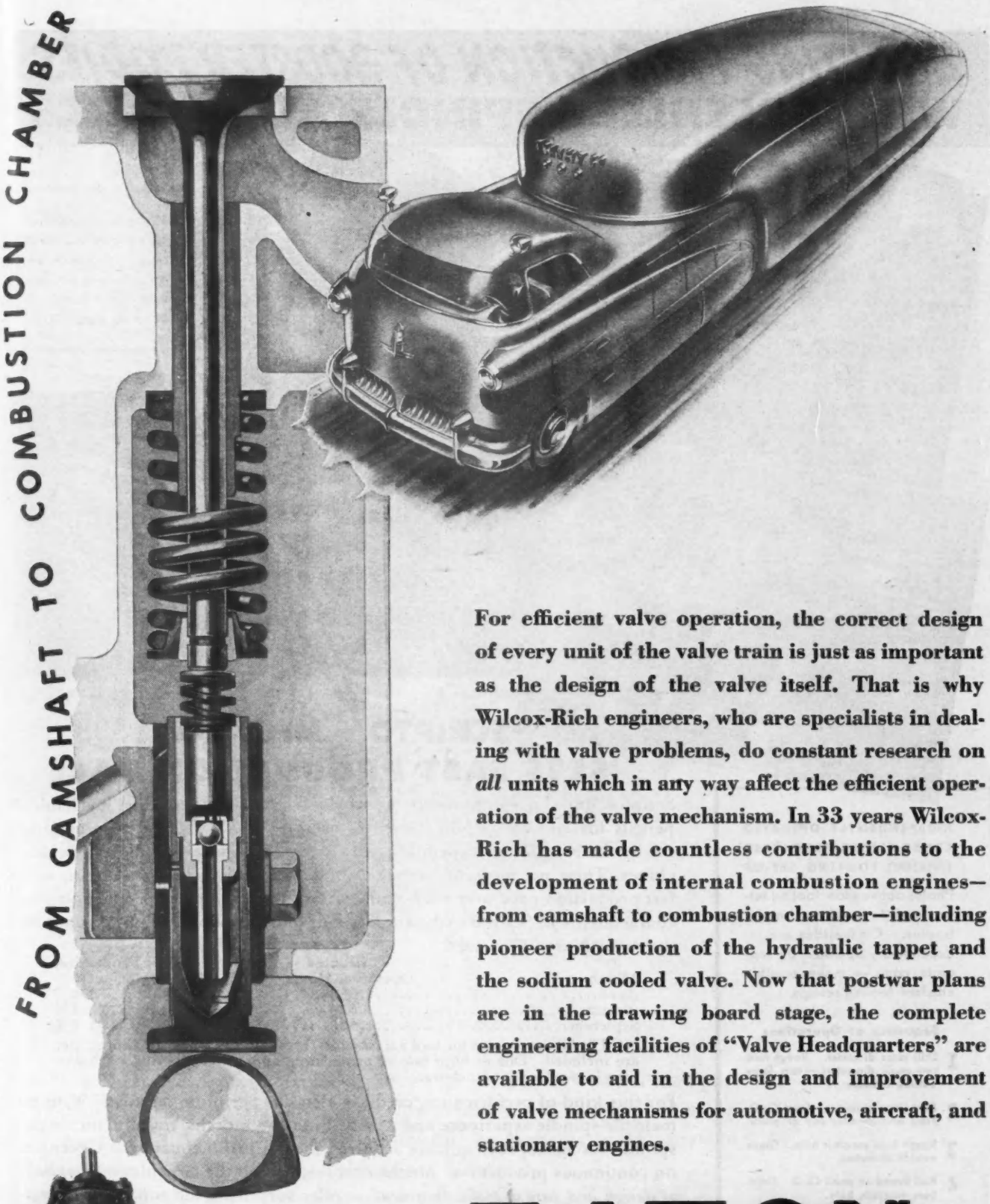
Elsco

SPRAYIT

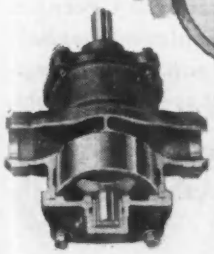
ELECTRIC SPRAYIT CO.

SHEBOYGAN, WISCONSIN

FROM CAMSHAFT TO COMBUSTION CHAMBER



For efficient valve operation, the correct design of every unit of the valve train is just as important as the design of the valve itself. That is why Wilcox-Rich engineers, who are specialists in dealing with valve problems, do constant research on *all* units which in any way affect the efficient operation of the valve mechanism. In 33 years Wilcox-Rich has made countless contributions to the development of internal combustion engines—from camshaft to combustion chamber—including pioneer production of the hydraulic tappet and the sodium cooled valve. Now that postwar plans are in the drawing board stage, the complete engineering facilities of "Valve Headquarters" are available to aid in the design and improvement of valve mechanisms for automotive, aircraft, and stationary engines.



IN ADDITION TO the Eaton Rotor Pump (shown at left) the Wilcox-Rich Division of Eaton Manufacturing Company produces parts for the complete valve assembly—including Zero-Lash Hydraulic Valve Mechanisms, Mechanical Tappets, Self-Locking Screws, Valve Springs, Valve Seat Inserts, and Automotive and Aircraft Valves.

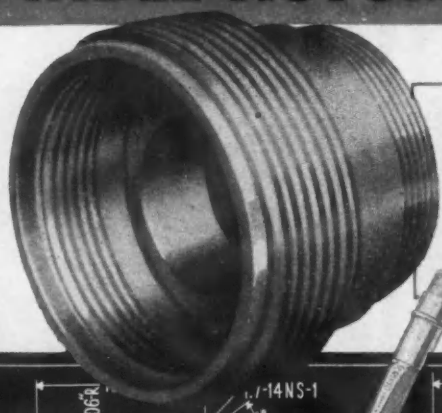
EATON

MANUFACTURING COMPANY

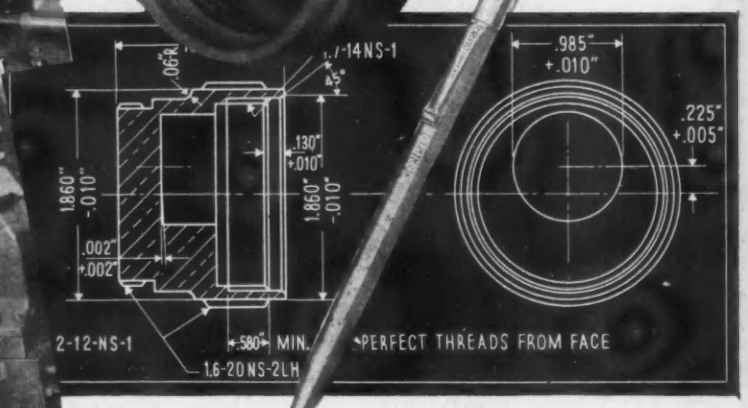
WILCOX-RICH DIVISION

9771 FRENCH ROAD • DETROIT 14, MICHIGAN

BOOSTING PRODUCTION OF BOOSTER BODIES WITH GREENLEE 6 SPINDLE AUTOMATICS



15 Operations Completed in Record Time. Gross Production Rate — 400 Per Hour or 9 Seconds Per Piece.



INDEPENDENTLY OPERATED CROSS-SLIDES PERMITTED EFFICIENT TOOLING SET-UP

Photos above show tooling set-up used to produce booster bodies. Cross-slides are independently operated by separate cams — make possible efficient tooling set-ups.

Sequence of Operations

1. Drill large diameter. Rough form two small diameters — turn large outside diameter.
2. Bore large diameter. Form O. D. Face and chamfer end of piece.
3. Rough bore eccentric hole. Shave outside diameters.
4. Roll thread on small O. D. Finish bore eccentric hole.
5. Cut thread on large O. D. Chamfer and break down for cut-off.
6. Tap inside thread. Cut-off.

Gross Production Rate — 400 per hour

SCRIPTO MFG. CO. SETS FAST PRODUCTION PACE

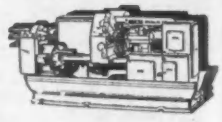
Scripto Mfg. Co. — producers of world famous, high quality mechanical pencils for consumers and industrial users — has established a noteworthy record in production expediting with two Greenlee 6-Spindle Screw Machines. Their net machine output of brass boosters, a shell fuse part, set a fast production pace over a 2½ year period. Here is typical production data characteristic of Scripto's efficient methods of operation which has won them the Army-Navy "E" Award:

Month	Scheduled Operating Hours	Net Production Efficiency
April	638	78.0%
August	626	71.5%
September	528	74.6%

NOTE: All time losses for tool adjustments, breakage, mechanical failures, etc. are included. Due to high rate of production, approximately 10% of down-time is required for stocking.

For this kind of performance, credit is also due Scripto operators. With no multiple-spindle experience and with as little as 3 months' training on single-spindle machines, they quickly acquired the skill to maintain the Greenlees on continuous production. Mechanical features on the Greenlee — *simplicity of design and ease of tool adjustments* — offer surprising aid today under war-time conditions and promote efficiency on many short as well as long run jobs.

Write today for full facts.



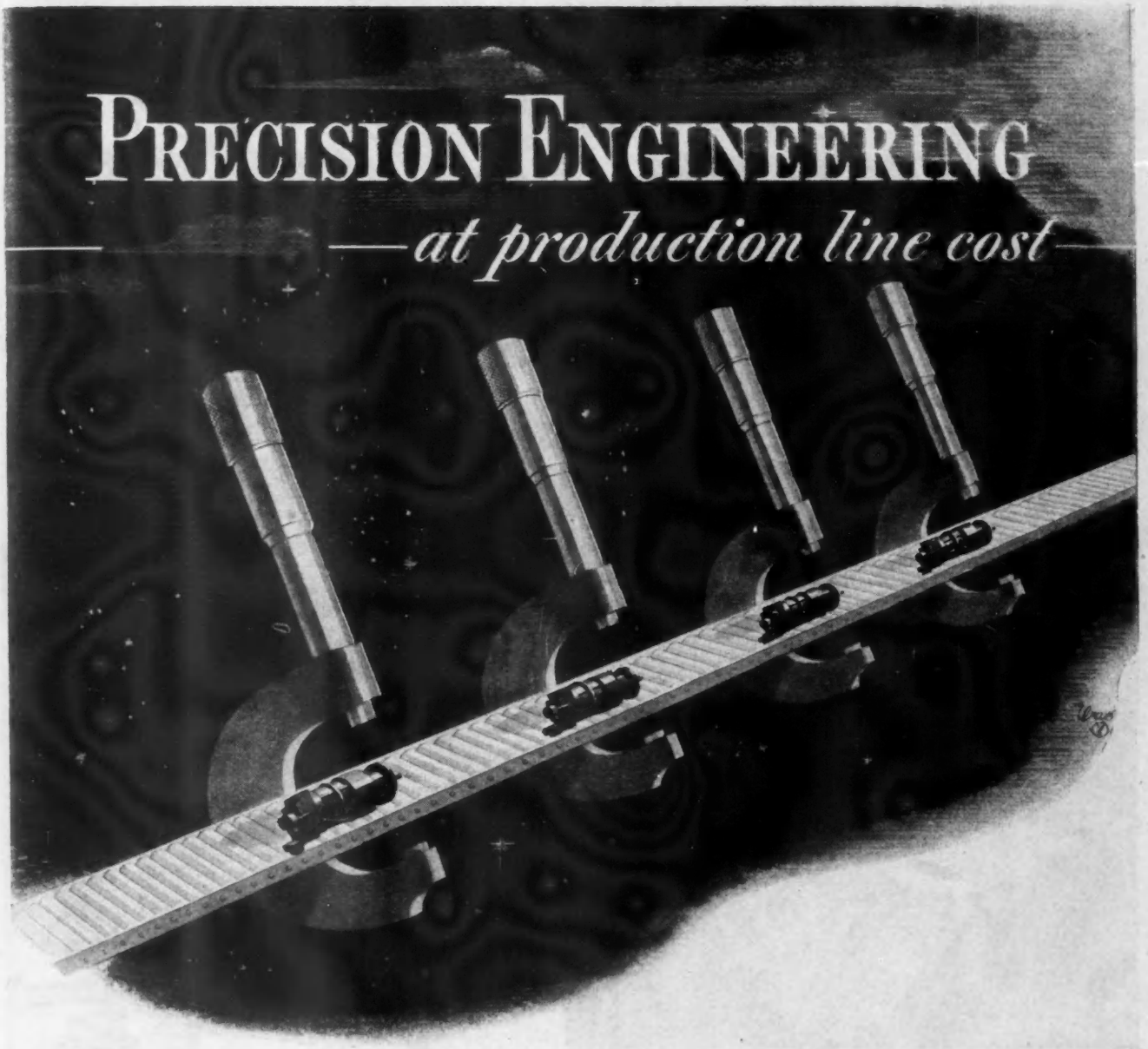
GREENLEE BROS. & CO.
1771 MASON AVE., ROCKFORD, ILLINOIS

GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

PRECISION ENGINEERING

—at production line cost—



IN 3 weeks Jack & Heintz designed a unique retraction motor for the Air Forces . . . made important improvements in motor performance and life that had never before been thought possible . . . and in 2 more weeks were producing it in production-line quantity at a lower price to the government. When the war is won this Jack & Heintz ability will be available to industry—to help you with better parts or products, engineered and produced with new precision at production-line speed and low cost, to meet your postwar competition. We would like to show you this unique combination at work now. Jack & Heintz, Inc., Cleveland, Ohio, manufacturers of aircraft engine starters, generators, gyro pilots, gyro flight instruments, magnetos, motors.

JAHCO

JACK & HEINTZ

Incorporated

FOR A TICKLISH FINISHING PROBLEM

Call on Kellerflex

1 The slots in this bronze casting are designed to contain blocks of lignum vitae driven in and finished to form an underwater bearing. Obviously the rough slots have to be smoothed down so the wood blocks will seat properly. *But* these slots are inaccessible for ordinary machining methods.

3 From very little up to as much as 3/16" of metal had to be removed in cases where humps existed on the casting. After the Kellerflex did its work, only a small amount of hand scraping was required for leveling up. And time for the job was cut 60%—70%.

Read of this typical case where Pratt & Whitney's Kellerflex flexible shaft equipment "took over" a job that was impossible to do with ordinary machining methods . . . cut operation time by 60%—70% over the hand method!

2 No problem for Kellerflex. With the right-angle hand-piece and the special bur illustrated here, what *could* have been a tedious, difficult job of hand scraping and filing turned out to be simple as A-B-C!

Kellerflex JB-1 with right angle hand piece.

Versatile, dependable, and time-saving, the Pratt & Whitney Kellerflex can take on an infinite number of finishing jobs . . . do them better and do them faster. It is precision-built to the high Pratt & Whitney standards of accuracy—your guarantee of a machine that will stand up and do the job *right*. For full details of various machines and the wide variety of additional equipment and accessories, address our nearest branch office . . . or contact our headquarters. Pratt & Whitney, *Division* Niles-Bement-Pond Company, West Hartford 1, Connecticut. . . . Kellerflex Sales Department.

PRATT & WHITNEY

***Division* Niles-Bement-Pond Company**

WEST HARTFORD 1, CONNECTICUT

PROOF...
OF PEAK PERFORMANCE BY CLE-AIR SPRING CONTROL UNITS

OSHKOSH CITY LINES, INC.
60 LIGHT STREET TELEPHONE 1077 OSHKOSH, WISCONSIN

J. T. PUTNEY, PRESIDENT
F. S. PUTNEY, SECY.-TREAS.

September 29, 1944

Mr. H. A. Lantz, Sales Manager
The Cleveland Pneumatic Tool Company
3781 East 77th Street
Cleveland 5, Ohio

Dear Sir:

One of the greatest mysteries in our past ten years has been shock absorbers -- and expensive too. And to work on them -- that is another story.

Now, we think we have solved this problem ..... First, your CLE AIR Shocks. Second, a spare set and every 10,000 miles off they come and it's only a ten minute job. Another ten minutes and the old ones are cleaned, the few drops of oil necessary installed -- where it can properly be done -- on the bench, and we are ready for the next one.

One hundred thousand miles is not far in these days of global distances, but I would not want to push a peanut with my nose that far. And to date they have gone 100,000 miles and about fifteen cents cost for oil.

Perhaps secondary is the better riding by a d---sight. And springs -- not one broken leaf since these shocks have been installed. That is why they are now standard on all fo: corners of our coaches.

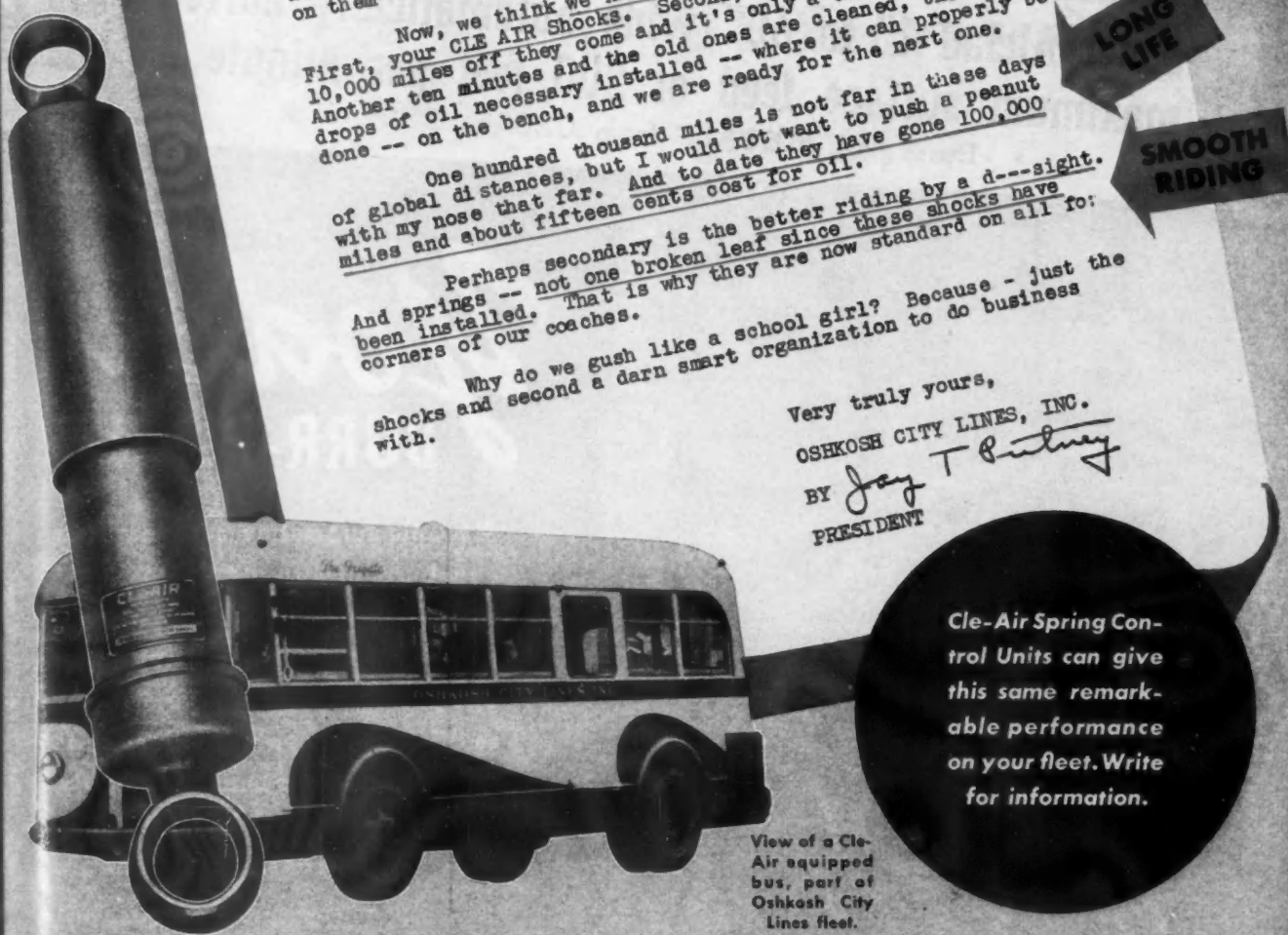
Why do we gush like a school girl? Because - just the shocks and second a darn smart organization to do business with.

Very truly yours,
OSHKOSH CITY LINES, INC.
BY Jay T Putney
PRESIDENT

NOTE:
For 2 consecutive years, Oshkosh City Lines, Inc., won the Bus Transportation National Maintenance Award for cities of their size.

LONG LIFE

SMOOTH RIDING



Cle-Air Spring Control Units can give this same remarkable performance on your fleet. Write for information.

View of a Cle-Air equipped bus, part of Oshkosh City Lines fleet.

THE CLEVELAND PNEUMATIC TOOL CO.
AUTOMOTIVE DIVISION **CLEVELAND 5, OHIO**

A New Way to Cut Burring Costs

Sheet Alclad 1" to 60" wide automatically burred at maximum surface feed of 200 feet per minute . .

Burrs **ALL METALS** from .020" to .250" thick

Yoder BURR-PLANER

A simple automatic machine which cuts burrs to within .001" to .005" . . . rolls down balance . . . leaves holes in working condition after one pass. Savings in time as high as 85% have been made in aircraft work, where it has been thoroughly production-tested. Prompt deliveries. Write for descriptive bulletin.

THE YODER COMPANY

5500 WALWORTH AVE. • CLEVELAND 2, OHIO

B-29

LIGHT Heavyweight Champion . . .

BUY WAR BONDS

The B29 is more than just big. This newest bomber ranges farther . . . hits new speeds . . . reaches new ceilings . . . lugs bigger bomb loads than any plane ever carried before. Reduction of weight in the construction of this new superfortress plays an important part in making such performances possible.

For example, the revolutionary use of aluminum in starter cable has cut the cable weight in half on our heavy bomber and fighter planes. Such aluminum starter cable is manufactured by the Wire and Cable Division of Auto-Lite.

This new type cable is one of many contributions Auto-Lite is making to help improve the mechanized weapons of America's Armed Forces.

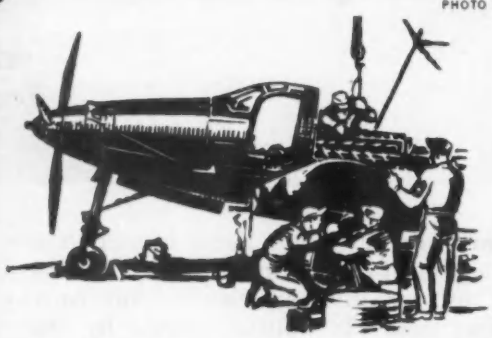
THE ELECTRIC AUTO-LITE COMPANY

TOLEDO 1, OHIO

AUTO-LITE

TUNE IN "EVERYTHING FOR THE BOYS" STARRING DICK HAYMES—EVERY TUESDAY NIGHT—N B C NETWORK

PHOTO COURTESY U. S. SIGNAL CORPS



You never hear of him, much less see him . . . He is seldom decorated . . . Yet he and his men keep our heavy bombers, our mediums and our fighters in the air . . . He's the Line Chief.

STRAINING up narrow mountain ledges hewn by American bulldozers through rock and shale . . . Down into mucky bogs, reeking with mud and blood . . . Across shifting, treacherous, blistering desert sands, hotter than the hubs of hell . . . Speeding over roads built by the Romans, tried through the centuries . . . Wheels. Thousands of them . . . Erie Wheels bearing supplies, munitions and men . . . ordnance, food, ambulances . . . Wheels rolling the American Armed Forces toward victory . . . We salute all makers of wheels, for together we bear the loads that translate the Four Freedoms and the Bill of Rights to action.

Erie Wheels

ERIE MALLEABLE IRON CO. ERIE, PENNSYLVANIA

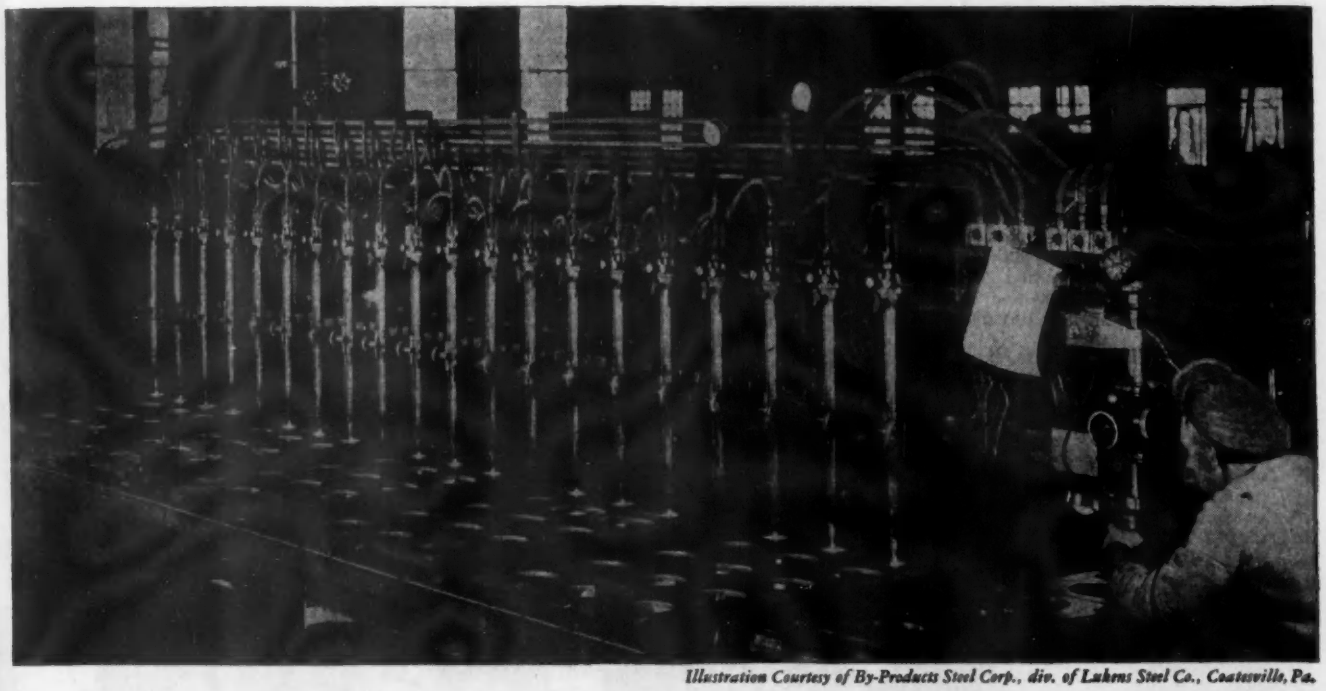
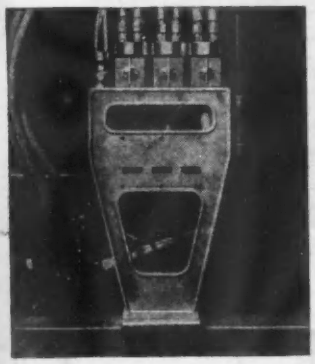
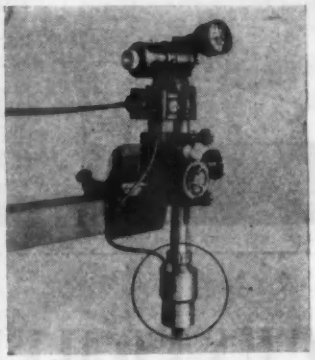


Illustration Courtesy of By-Products Steel Corp., div. of Lukens Steel Co., Coatesville, Pa.



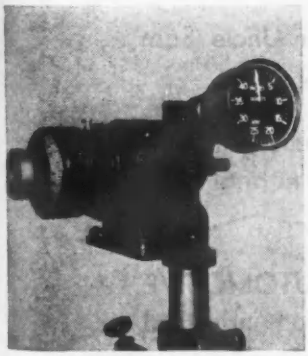
CENTRALIZED GAS CONTROL UNIT

Gives the operator remote control of the pilot light, acetylene, preheating and cutting oxygen from his station at the tracing device.



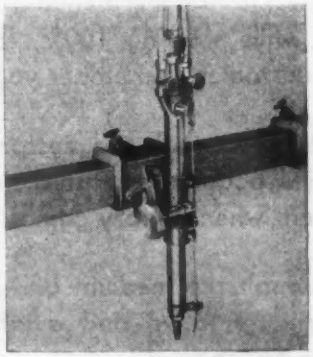
MAGNETIC TRACING DEVICE

An exclusive Airco feature, this device guides cutting torches by automatically following the contour of a steel cam or template.



INDEX SPEED CONTROL

Permits easy, accurate adjustment of torch travel speed during cutting. Speed is visible on the Tachometer attached to the unit.



ADJUSTABLE TORCH HOLDER

Allows torch to be moved easily and locked tightly at any desired position along the bar or tilted up to 45° for bevel cutting.

CUTTING METAL PARTS, CUTTING COSTS

with the

AIRCO No. 6A OXYGRAPH

The motor-driven Airco No. 6A Oxygraph is designed to provide the speed, flexibility and accuracy essential to lowest-cost production of flame-cut steel shapes in any quantity.

It quickly cuts steel plate of light and heavy sections to any shape and size. It can be used for beveling, squaring, straight cutting, stack cutting—changing from one job to another in minimum time—using up to eight torches with standard equipment.

The listing below of some of the plus factors of the No. 6A Oxygraph provides an inkling of its wide acceptance throughout the metal working industry as an important production tool:

1. Extreme accuracy under load—the pantograph design provides maximum resistance to torsion and deflection.
2. The rigid, sturdy base gives trouble-free support to the stout vertical posts and pantograph assembly.
3. Manual, magnetic or spindle type tracing devices can be used.
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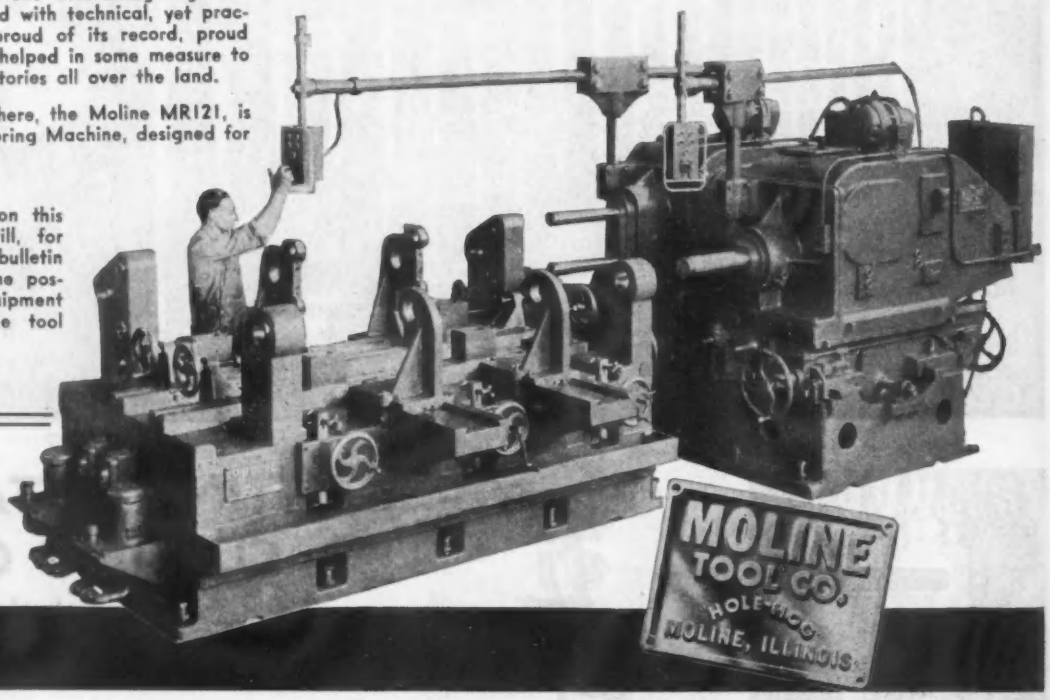
Send for information on this machine or, better still, for general descriptive bulletin which will show you the possibilities of Moline equipment for your own machine tool requisities.



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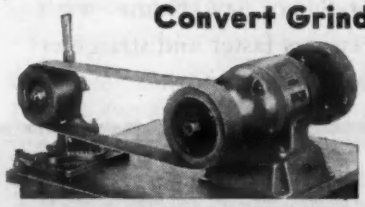

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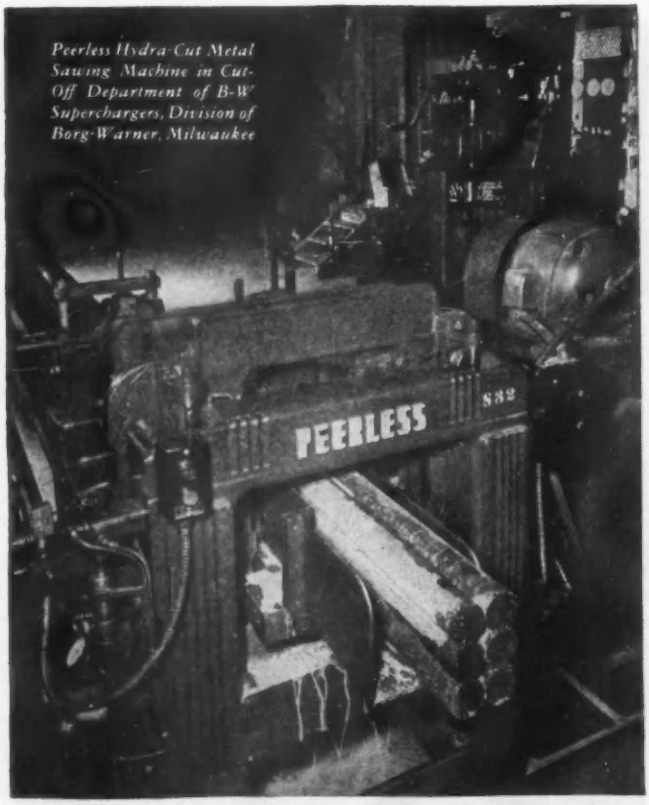

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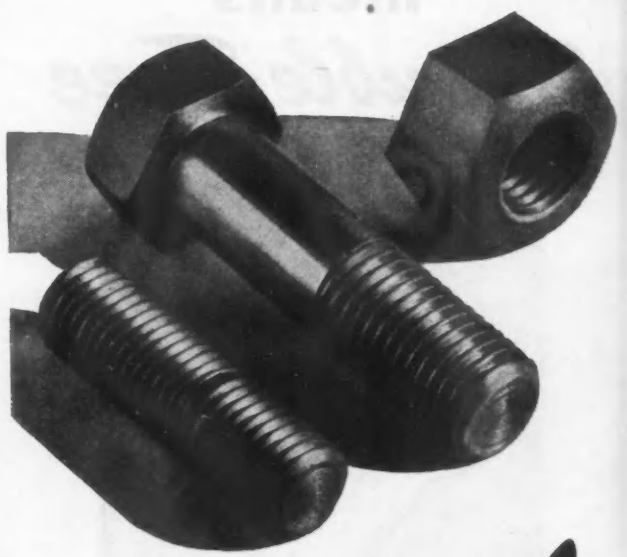

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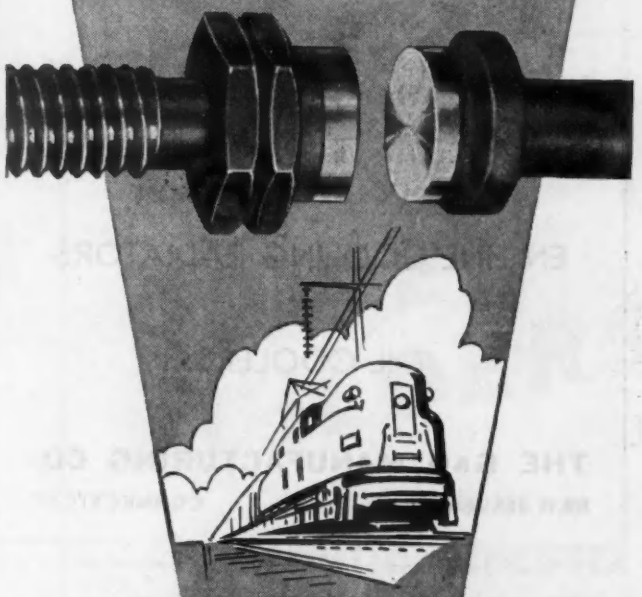

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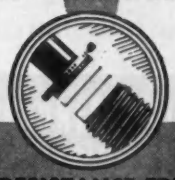

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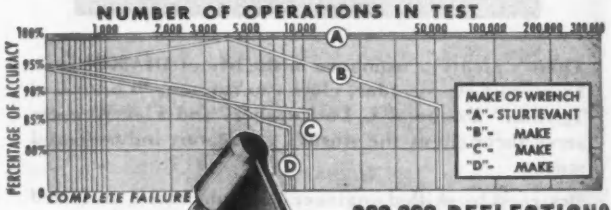

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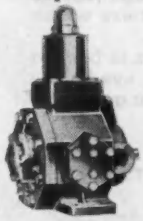

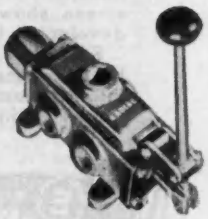

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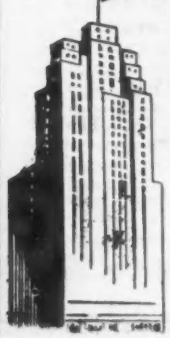

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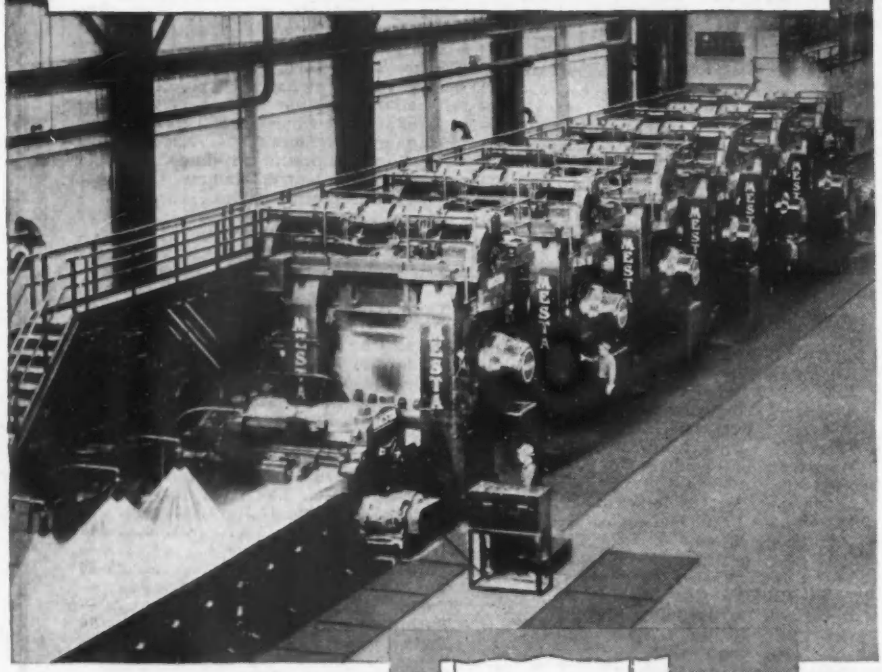
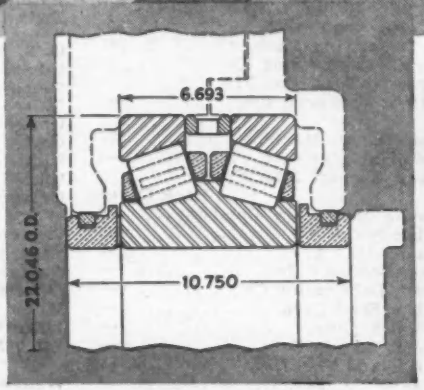
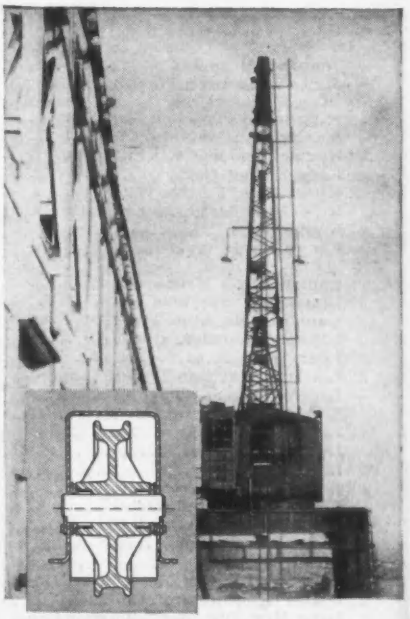
IN THE NEWS
WITH TORRINGTON BEARINGS



THIS 80" FOUR-HIGH CONTINUOUS HOT STRIP MILL, installed in one of the world's largest steel rolling plants, utilizes Torrington two-row tapered roller bearings (see cross-section) to carry the thrust loads encountered in the operation of the back-up rolls. With each row employing 23 rollers 2¼" long and 2" in diameter, these bearings have a thrust load capacity of 220,900 pounds at 100 R.P.M. Supplying the steel industry with a wide range of anti-friction bearings is an important part of the service of Torrington's Bantam Bearings Division.





THIS MAMMOTH REVOLVING GANTRY CRANE, built by the American Hoist & Derrick Company, entrusts its multi-ton loads to Torrington Needle Roller Bearings, supplied by the Company's Bantam Bearings Division. Combining the advantage of compact design and high load capacity with economy, these anti-friction bearings were specified for installation in the wheels of the crane's equalizing non-swiveling truck, as shown in the accompanying cross-section.

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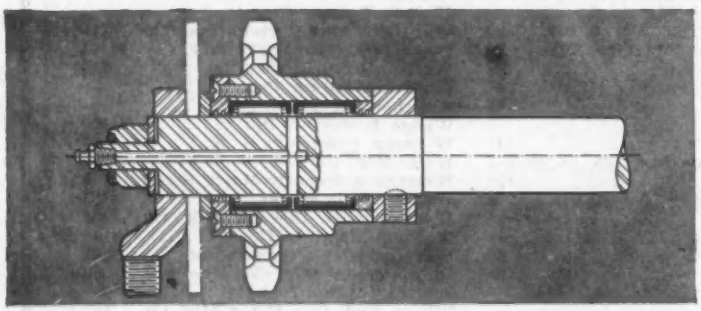

SHUTTLE CARS, built by the Joy Manufacturing Company, have the distinction of being able both to carry and unload their own cargoes. Designed for the rapid transfer of coal and other materials, these cars discharge their loads within a few seconds by means of a 32" conveyor chain that rides in the center of the chassis. Accompanying cross-section shows the installation of Torrington Type NC Needle Bearings as they are employed in the take-up mechanism of the chain.

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